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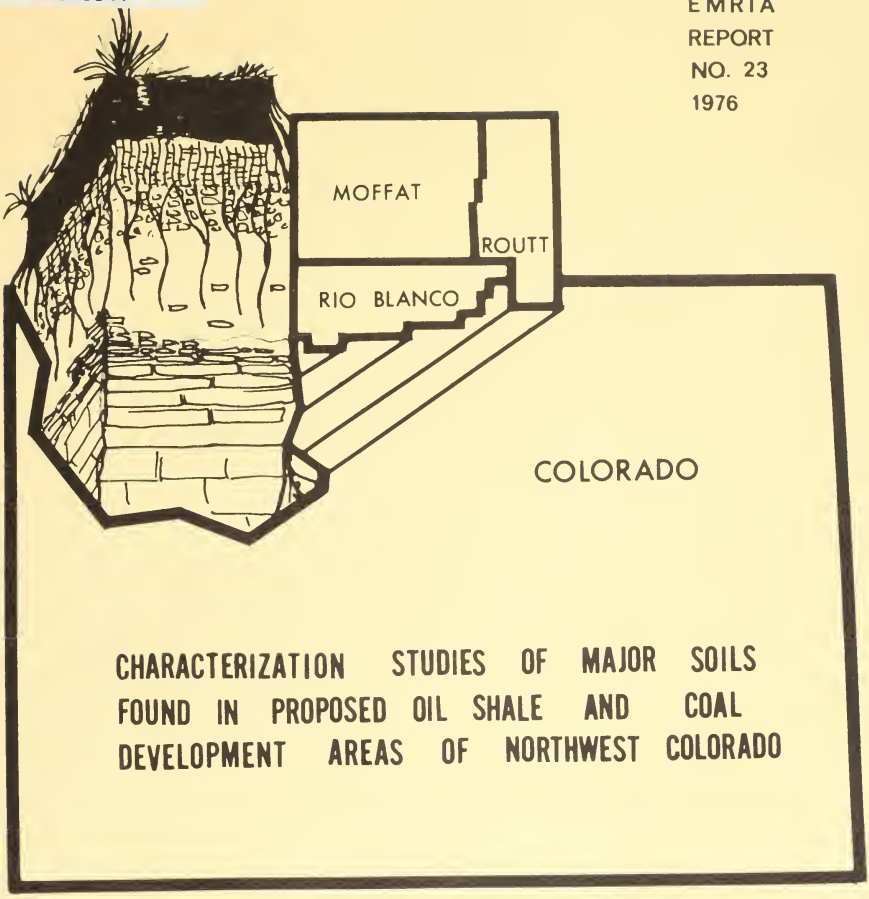

CHARACTERIZATION STUDIES OF MAJOR SOILS FOUND IN PROPOSED OIL SHALE AND COAL DEVELOPMENT AREAS OF NORTHWEST COLORADO

FINAL REPORT - SEPTEMBER 1. 1976
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FINAL REPORT

November 19, 1976

to the

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EMRIA - Energy Mineral Rehabilitation Inventory and Analysis

EMRIA is a coordinated approach to field data collection, analysis, and interpretation of soil, water, overburden and energy resource data. The main objective of the effort is to assure adequate baseline data for choosing reclamation goals and establishing of lease stipulations through site-specific pre-planning for surface mining and reclamation.

These reports are prepared through the efforts of the Department of the Interior, principally by the Bureau of Land Management, Bureau of Reclamation, and Geological Survey. Assistance is also provided by other Federal and State agencies.

Reports under this effort are:

EMRIA Report	Location	Source - BLM Offices
#1-1975	Otter Creek near Ashland Montana	316 N. 26th Street Billings, Montana 59101
#2-1975	Hanna Basin near Hanna, Wyoming	P.O. Box 670 Rawlins, Wyoming 82301
#3-1975	Taylor Creek near Craig, Colorado	Room 700, 1600 Broadway Denver, Colorado
#4-1975	Alton near Kanab, Utah	P.O. Box 11505 Salt Lake City, Utah 84111
#6-1976	Characterization Studies of Major Soils Found in Proposed Oil Shale and Coal Development Areas of Northwest Colorado	Room 700, 1600 Broadway Denver, Colorado 80202

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CHAPTER I

INTRODUCTION

An important aspect associated with proposed oil shale development and expanding coal mining in northwestern Colorado is adequate reclamation and stabilization of land disturbed by these activities. Critical to this aspect is soil management, which includes a knowledge of the soil properties and an understanding of how these properties may affect soil behaviour.

Soil classification is needed to organize our knowledge of soils in an orderly manner so that we can compare soils from one area to another and display soils information on maps in order to determine the geographical distribution and extent of soils. Soil classification is also important because it reflects soil conditions in relation to the environment in which the soil has developed, which in turn allows us to develop basic principles with respect to the present and future behaviour and response of soils to management.

Soil morphological, chemical and physical characterization is needed to establish the ranges in soil properties that exist within and among the soils of a particular area. Thickness, structure, texture, pH, salinity level, etc., are properties and characteristics of the soils that must be known if we are to consider adequately such soil quality factors as erodibility, productivity, workability and fertility, all of which are critical for developing successful land management programs.

OBJECTIVE OF STUDY

The major objective of this study is to provide comprehensive baseline characterization data for the major soils that occur within the oil shale and coal reserve areas of northwestern Colorado. Such data is essential for use in developing guidelines which reflect the opportunities and/or constraints that soils offer for reclamation and/or provide a basis for evaluating the adequacy of existing reclamation guidelines.

CHAPTER II

GENERAL DESCRIPTION OF THE STUDY AREA

Location

The study area is located within Moffat, Routt, Rio Blanco, and Garfield counties of Colorado. It roughly lies within an area bounded by Townships 7 North 3 South and Ranges 86 to 99 West. Figure 1 shows the approximate locations of the sites studied. A more specific location for each site studied is given in Appendix Table A-1.

Climate

The climate varies greatly but as a whole is generally considered semi-arid with relatively warm summers and cold winters. The extremes are due largely to the wide range in elevation and exposure. The mean annual temperature at Meeker is about 7° C. (44°F) with extremes of -42°C (-43°F) to 39°C (103°F). The mean annual temperature at Craig is 5.5°C (42°F) with a recorded high of 38°C (100°F) and a low of -42°C (-43°F). At Steamboat Springs, the mean annual temperature is 4°C (39°F), with extremes of 37°C (99°F) to -48°C (-54°F). Average annual precipitation varies from more than 1270 mm (50 inches) in the upper reaches of the White and Yampa River Basins to less than 228 mm (9 inches) at lower elevations. The range of annual precipitation in the study area is shown in Figure 2. This map was adapted from Annual Precipitation Map of Colorado (1930 to 1960) which was prepared by Environmental Science Services Administration, Weather Bureau, U.S. D. C. Annual frost-free period ranges from less than 50 days at higher elevations to an average of 124 days at lower elevations.

Seasonal distribution of precipitation is fairly uniform during the year. Slightly less than half of the precipitation occurs during the December-April period in the form of snow. About one-third usually occurs during the irrigation season, though this is variable with respect to location. Summer rainfall generally takes the form of showers that are highly variable and contribute much less to the overall water supplies. At higher elevations near the eastern edge of the White and Yampa River Basins, rainfall typically occurs as mountain thundershowers, with only limited areas having locally severe intensities. At lower elevations, summer showers are affected by convective conditions and frequently occur in the form of "cloudbursts". Floods are of short durations and low total water production, but peak flows are high. Evaporation studies are essentially lacking for the area under consideration. Data from comparable areas in the state indicate that average evaporation rates would range from 43 to 140 cm per year (17 to 55 inches per year).

Physiography

Most of the study area lies largely within the White River Basin and within the south central and south eastern sides of the Yampa River Basin.

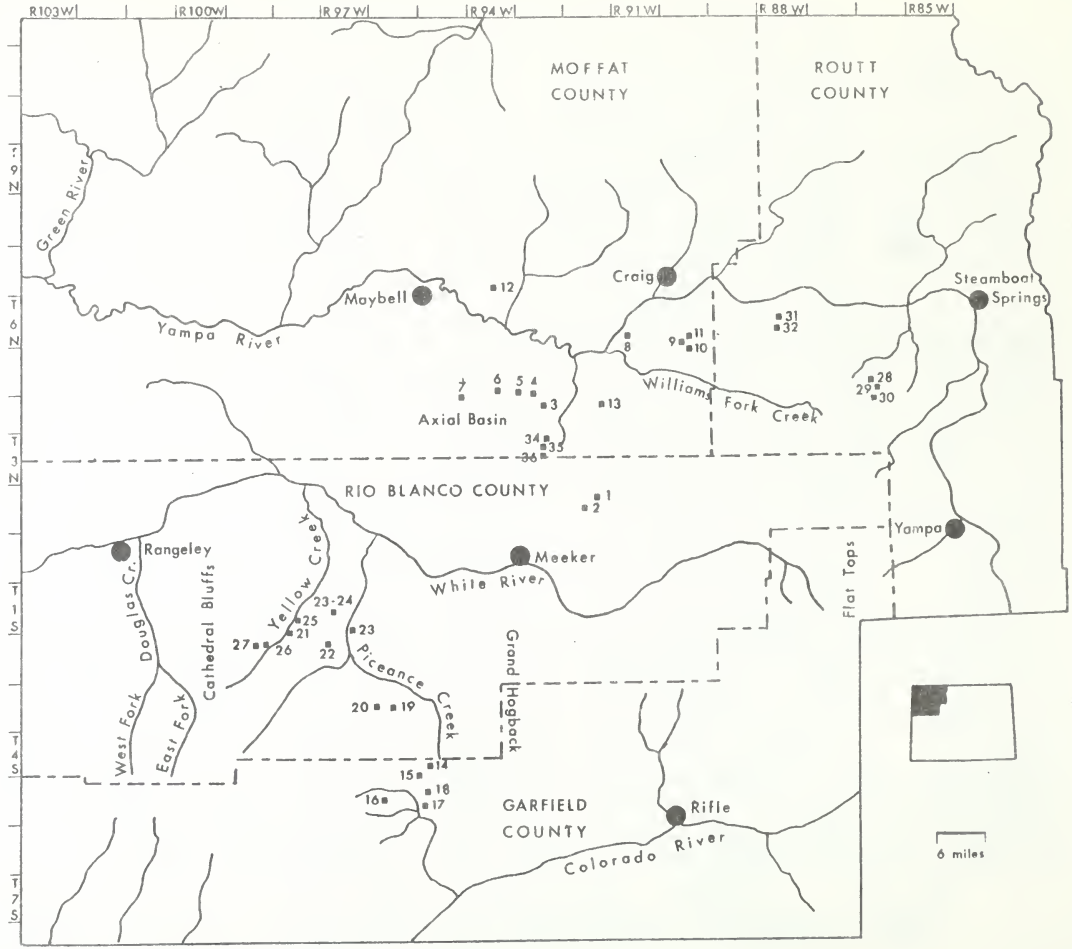


FIGURE 1. Approximate location of soil sampling sites.

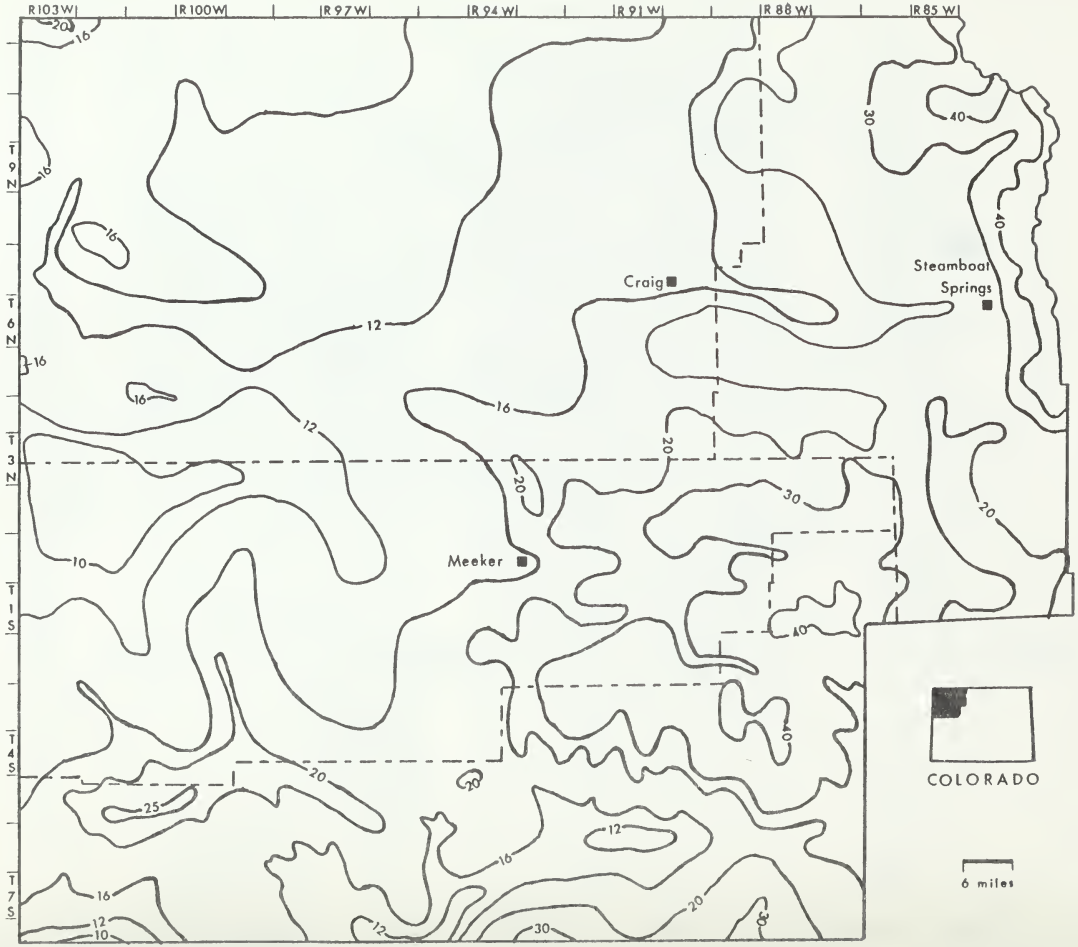


FIGURE 2. Distribution of annual precipitation for the study area.

The White River Basin extends across portions of two major physiographic provinces. The eastern one-third lies within the White River Plateau section of the Southern Rocky Mountain Province, while the western two-thirds is within the Uintan Basin section of the Colorado Plateau Province. Elevations vary from about 1525 meters (5000 feet), where the White River crosses the Colorado-Utah State line, to 3660 meters (12000 feet) on Shingle Peak in the Flat Tops of the White River Plateau.

Headwaters of the White River are located in the White River Plateau, a relatively flat high-lying area that has been moderately dissected by stream erosion and glacial action. While the plateau generally exceeds 2745 meets (9000 feet) in elevation, stream valleys through much of the area are from approximately 457 to 762 meters (1500 to 2500 feet) lower. In the Flat Tops area, elevations range from 3050 to 3507 meters (10,000 to 11,500 feet). Numerous lakes, mainly of glacial origin, occur throughout the higher parts of the plateau and along the upper reaches of the main valleys. The largest area of open and relatively level land is adjacent to the town of Meeker. The Grand Hogback is a prominent north-south ridge rising approximately 457 meters (1500 feet) above the surrounding area, and extending from near Meeker to beyond the south boundary of the White River Basin. It is formed mainly by steeply dipping resistant sandstone beds and marks the western boundary of the White River Plateau.

West of Meeker the Basin comprises an area of diverse topography including dissected lesser plateaus, sharp ridges, abrupt cliffs, and rugged badlands interspersed with open valleys, parks, and basins. The presence of underlying rock layers with wide differences in resistance to erosion has been the principal factor in development of these landscape features.

The Roan Plateau is a lightly dissected broad drainage divide that lies along the southern edge of the area within the upper drainage basins of Piceance and Douglas Creeks. Elevations vary from about 1982 meters (6500 feet) to over 2745 meters (9000 feet). The Plateau area is characterized by rolling country containing many straight northeast-trending valleys that are mostly 19 meters (300 feet) below the general level of the upland surface.

The Cathedral Bluffs face westward toward the valley area of Douglas Creek and trend generally northward. The area east of the crest of the Cathedral Bluffs slopes gently northeastward toward Piceance Creek.

From Meeker westward to the Colorado-Utah State line is an area characterized by broad basins separated by rocky ridges and narrow plateaus. Elevations are from 1525 meters (5000 feet) to about 2623 meters (8600 feet) above the sea level. Bare rock surfaces are common on cliff faces, along dip slopes, and in badland areas.

Along the south-central side of the Yampa River Basin is a prominent topographic feature, the Axial Basin, formed by an uplift whose axis has been deeply eroded exposing underlying soft rocks and forming a sharply outlined trough. Two isolated mountains rise abruptly from the floor of this trough, namely, Juniper Mountain and Cross Mountain. The Yampa River cuts through both of these mountains in deep canyons.

Along the south side of the Axial Basin is a low range of hills, the Danforth hills, lying about 610 meters (2000 feet) above the adjacent valleys. Northeast of the Axial Basin, the Williams Fork mountains are a high hogback ridge formed by resistant sandstone layers.

Geology

Rocks ranging in age from Precambrian through Quarternary are exposed in both, the White and Yampa River Basins. Except for small areas of Precambrian Crystalline rocks and Tertiary Lava flows in the White River Plateau, they consist of a thick sequence of sedimentary rocks of Paleozoic, Mesozoic, and Tertiary age. The discussion here will deal mainly with those geologic materials on which the sites studied are located. These are, rocks of Tertiary and Mesozoic age. Rocks of Tertiary age include Tertiary Volcanics, Green River Formation, Wasatch Formation, Fort Union Formation, Bridger Formation, and Brown Park Formation.

The Green River Formation, which outcrops over most of the Piceance Creek basin, is composed mainly of light gray to light brown shale and marlstone with some sandstone, limestone, and oil shale. The Wasatch Formation, which also outcrops around the margins of the Piceance Creek, consists mainly of red, purple, and gray shale and clay with some sandstone layers. These rocks are relatively erodible and this formation generally forms broad valleys or badland areas between cliffs and ridges of the Green River Formation and the Mesa Verde group of Mesozoic age.

The Brown Park Formation consists predominately of chalky white to light gray soft crossbedded tuffaceous sandstone with thin layers of greenish gray snady mudstone.

Rocks of Mesozoic age which outcrop mainly around the Axial Basin and Williams Fork Creek basin, include several thousand feet of alternating beds of shale, siltstone, and sandstone. This sequence of rocks includes: the Moenkopi and Chinle Formation of Triassic age, the Navajoe sandstone of Triassic and Jurassic age, the Carmel Formation, Entrada sandstone, Curtis Formation, and Morrison Formation of Jurassic age; the Dakota sandstone and Mowry shale of early Cretaceous age, and the Frontier Formation, Mancos shale, Mesa Verde group, Lewis shale and Lance Formation of late Cretaceous age. The most extensive of the Mesozoic rocks are the Mancos shale and Mesa Verde group.

The Mancos shale consists essentially of dark gray calcareous marine shale and often underlies broad open valleys and basins.

The Mesa Verde group consists mainly of sandstone with interbedded shale and several coal beds. These rocks are usually resistant to erosion and often form prominent mesas, ridges and cliffs.

Native Vegetation

The native vegetation of the study area is dominantly composed of shrub-bunch grass type dominated by one or more species of

sagebrush (Artemisia spp.). Other important shrubby species include greasewood (Sarcobatus vermiculatus) which is partly or completely dominate on some saline and sodic soils, rabbitbrush (Chrysothamnus spp.) which is co-dominant on much of the area, bitterbrush (Persia Tridentata), snowberry (Symphoricarpos albus), serviceberry (Amerlanchier spp.), chokecherry (Prunus virginiana), and Gambel Oak (Quercus ganbelii). The sagebrush type occupies the area studied and extends up adjacent mountain valley to where it gives way to different types of trees at different elevations. Aspen (Populus tremuloides), Juniper (Juniperus utahensis), and pinyon pine (Pinus edulis) are the most common trees at elevations of 8000 to 9000 feet in the study area. Basic studies of the vegetation in the study area are lacking. Data from comparable areas in the state indicate that there is little mixing of different species of sagebrush except for narrow transitional zones between the types. Smith (1966) reported that big sagebrush (Artemisia tridentata) is by far the most common dominant, occupying probably 90 percent of all the sagebrush type. Artemisia longiloba dominates areas with clay-pan soils. Artemisia cana is found on limited areas, usually on poorly drained, nonsaline soils or at the higher elevations. Artemisia argilosa occurs on even smaller areas on heavy poorly drained, saline or sodic soils.

The herbaceous vegetation of the study area consists primarily of perennial bunch grasses and low growing perennial forbs. Very few annuals are present.

Further description of the vegetation associated with each soil studied is given in Appendix B. A general natural vegetation map of the study area can be obtained from the "Natural Vegetation Map of Colorado", prepared by the Soil Conservation Service, U.S.D.A., 1972.

Soils

At the time this study was initiated, there was little detailed soil survey information available for the study area. A general soil map for the four counties where the study area is located is given in Figure 3. This map was adapted from the General Soil Map of Colorado which was prepared by the Soil Conservation Service (1975). The general soil map is discussed only with respect to those soil mapping units within which study sites occurred. The description of these mapping units was taken from Soils of Colorado by Heil, et al (submitted for publication). The following generalized description of soils is given for the purpose of showing the general relationship among soils, vegetation, climate and geology for the study area as a whole. A complete morphological description and classification of each soil studied is given in Appendix Tables A-1 and A-3.

General Description of Selected Map Units as shown in Figure 3.

Map Unit 10. USTOLLIC HAPLARGIDS, loamy, nearly level to gently sloping.

This map unit is widely dispersed in Moffat, Rio Blanco, and Garfield counties. These soils are formed in eolian or partly wind reworked alluvial materials and medium textured sediments. Ustollic Haplargids make up about 65 percent of this map unit. The remaining 35 percent of this map unit

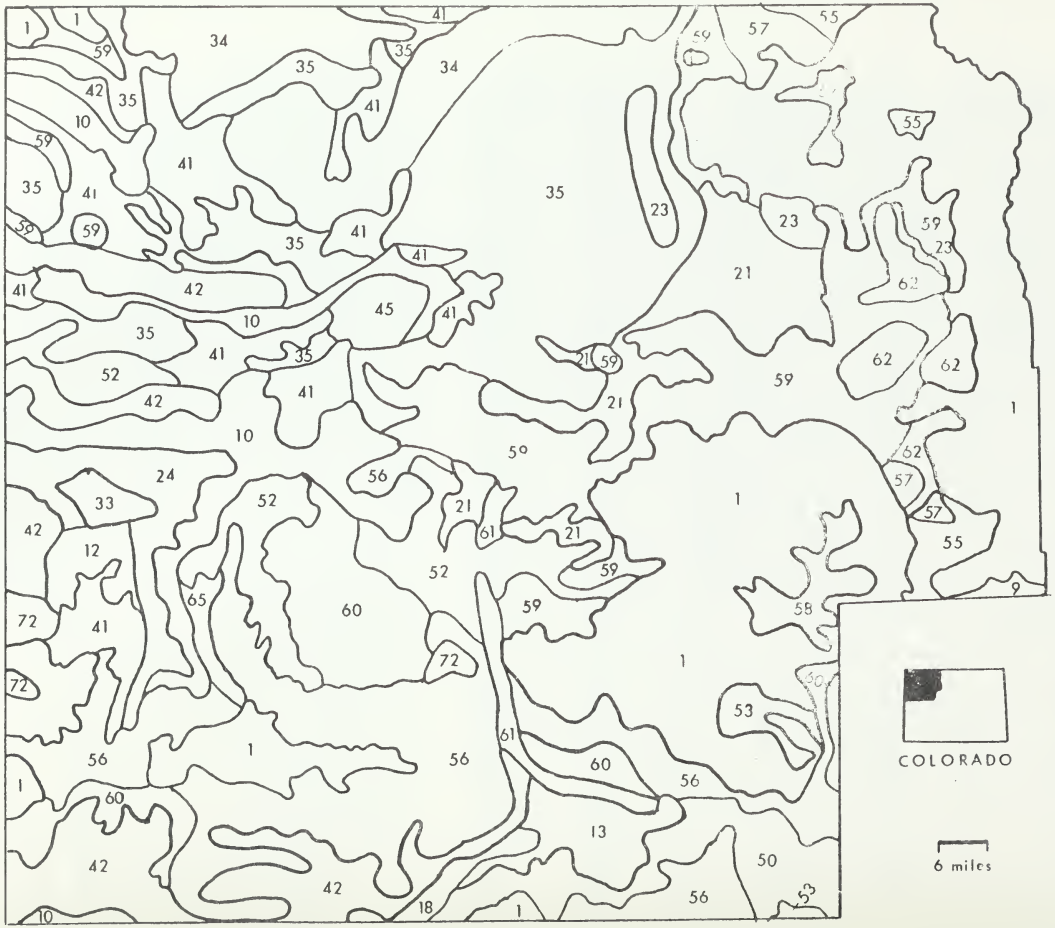


FIGURE 3. General soil map of the study area.

includes similar soils with dark colored surface layers, soils with less developed subsoils and some sandy soils. Ustollic Haplargids are deep, ligh colored, well drained soils having loamy texture and contain <35 percent rock fragments. These soils are on nearly level to gently sloping uplands and high terraces, and slopes ranges from 0 to 5 percent. Depth to bedrock is >152 cm (60 in.) and depth to the seasonal high water table is >1.8 meters (6 feet). Permeability is moderate to rapid, and soils have a low shrink-swell and frost action potential. They are typically neutral in upper layers and moderately alkaline and calcareous in the lower part.

Map Unit 21. BORALLIC CAMBORTHID, ARIDIC ARGIBOROLLS, loamy, gently sloping to moderately steep.

This map unit is located in southeastern Moffat, western Routt, and north central Rio Blanco counties. The dominant soils are formed in material weathered residually from shale. The less extensive soils are formed primarily in eolian and alluvial deposits.

Borollic Camborthids: These moderately deep to deep, well drained, light colored soils usually have clayey textures, but some areas have loamy subsoils. Rock fragments comprise <35 percent of the soil volume and are mainly shale chips or fragments of sandstone. These soils are on gently sloping to moderately steep uplands and have slopes of about 2 to 25 percent. Depth to bedrock ranges from 50 to >52 cm (20 to>60 in.), and depth to the seasonal high water table is >1.8 meters (6 feet). Permeability is slow where subsoils are clayey and moderately where loamy. The shrink-swell potential is high for clayey subsoils and low for loamy. The frost action potential is low. They are typically slightly or moderately alkaline in the surface layers and moderately alkaline in the lower part.

Aridic Argiborolls: These deep, dark colored, well drained soils dominately have loamy subsoils, but some are clayey. Rock fragments are 35 percent above a depth of 50 cm (20 in.) but may be >35 percent below this depth. These soils are found gently sloping to moderately steep alluvial fans, high terraces or valley sideslopes. Slopes range from 2 to 20 percent. Depth to bedrock is >152 cm (60 in.) and depth to the seasonal high water table is >1.8 meters (6 feet). Permeability is moderate where the subsoil is loamy and moderately slow where clayey. The shrink-swell potential ranges from low to high but is more commonly moderate. The frost action potential is low or moderate. These soils are typically neutral or mildly alkaline in the lower part.

Map Unit 35. USTIC TORRIORTHENTS, ARIDIC ARGIBOROLLS, loamy nearly level to sloping.

This map unit is found mostly in eastern Moffat County, but smaller areas also occur in the western part. The soils are formed dominantly in materials weathered in place from sandstone and shale.

Ustic Torriorthents make up about 30 percent of this map unit, and Aridic Argiborolls about 30 percent. The remaining 40 percent is mainly composed of deep and moderately deep light colored soils, about two-thirds of which are loamy and one-third clayey.

Ustic Torriorthents: These are moderately deep to shallow, light colored, well drained soils. About two-thirds have loamy textures and one-third have clayey textures. Rock fragments generally comprise 35 percent of the soil volume. They are on nearly level to sloping uplands and valley side slopes and have slopes of 0 to about 15 percent. Depth to bedrock ranges from 25 to 91 cm (10 to 40 in.) and the depth to the seasonal high water table is over 1.8 meters (6 feet). Permeability is moderate on loamy soils and slow on the clayey soils. The shrink-swell potential is low on the loamy soils and moderate to high on the clayey soils. The frost action potential is low to moderate. These soils are typically neutral to mildly alkaline in the upper layers and mildly alkaline to strongly alkaline in the lower part, but much of the coarser textured soils are neutral throughout.

Map Unit 41. LITHIC USTIC TORRIORTHENTS, USTIC TORRIORTHENTS, loamy, sloping to steep.

This map unit is mostly in western Moffat and western Rio Blano counties. The soils in this unit occupy mesas and breaks and are formed in materials weathered from shale and sandstone.

Lithic Ustic Torriorthents make up about 65 percent of this map unit, and Ustic Torriorthents about 30 percent. The remaining 5 percent is mostly composed of rock outcrop.

Lithic Ustic Torriorthents: These shallow, ligh colored, well drained soils have loamy textures and usually contain <35 percent rock fragments, but some contain up to 85 percent. These soils are on sloping to steep uplands and mesas, and slopes range from about 5 to 50 percent. Depth to bedrock is <51 cm (20 in.), and depth to the seasonal high water table is >1.8 meters (6 feet). Permeability is moderate above the bedrock, and the shrink and swell and frost action potential is low. Typically they have neutral to mildly alkaline surfact layers and are moderately alkaline in the lower part.

Ustic Torriorthents: These soils are like the Lithic Ustic Torriorthents except that depth to bedrock ranges from 51 to >152 cm (20 to 60 in.) and they are generally on lesser slopes. Slopes typically range from 5 to 30 percent.

Map Unit 52. ARIDIC ARGIBOROLLS, ARIDIC HAPLOBOROLLS, clayey, gently sloping to steep.

This map unit is found mostly in Rio Blanco county. The soils in this unit are formed in wind laid materials. Aridic Argiborolls make up about 60 percent of this map unit, and Aridic Haploborolls about 20 percent. The remaining 20 percent is composed of similar soils having loamy textures; colder soils at the higher elevations; Rock outcrop along the breaks, and dark colored poorly drained soils along streams and in depression areas.

Aridic Argiborolls: These are moderately deep to deep, dark colored well drained, clayey soils usually containing <35 percent rock fragments. They

are on gently sloping to steep soils on mesas, valley sideslopes, alluvial fans and old terraces and have slopes ranging from 3 to 40 or more percent. Depth to bedrock ranges from 51 to 152 cm or more (20-60 in.), and depth to the seasonal high water table is over 1.8 meters (6 feet). Permeability is slow; the shrink-swell potential is high; and the frost action potential is moderate. Typically these soils are neutral to mildly alkaline in the upper layers and mildly or moderately alkaline in the lower part.

Aridic Haploborolls: These soils are similar to the Aridic Argiborolls except that they have less well developed subsoils.

Map Unit 56. TYPIC CRYOBOROLLS, TYPIC CRYOBORALFS, skeletal, moderately steep and steep.

This map unit is found primarily in Rio Blanco and Garfield counties. The soils are in material largely weathered in place from shale and sandstone. Typic Cryoborolls make up about 40 percent of this map unit, and Typic Cryoboralfs about 35 percent. The remaining 25 percent of this unit is composed of rock outcrops, shallow soils < 51 cm (20 in.) to bedrock, and soils with weakly developed subsoils.

Typic Cryoborolls: These moderately steep and steep, dark colored, well drained clayey soils usually contain < 35 percent rock fragments, but sometimes contain as much as 80 percent. They are moderately steep to steep soils on mountain sides, hills and crests, and have slopes of 15 to 50 percent. Depth to bedrock is usually over 102 cm (40 in.) but ranges from 51 to over 152 cm (20 to over 60 in.), and the depth to the seasonal high water table is over 1.8 meters (6 feet). Permeability is slow or moderately slow, shrink-swell potential is moderate. Typically these soils are neutral or mildly alkaline in the surface layers and mildly or moderately alkaline in the lower part.

Typic Cryoboralfs: These moderately deep to deep, light colored, well drained soils have loamy or clayey textures, and usually contain from 35 to 38 percent rock fragments. They are moderately steep to steep soils found on mountain sides and crests and have slopes of 15 to 50 percent. Depth to bedrock is usually over 102 cm (40 in.) but ranges from 51 to over 152 cm (20 to over 60 in.), and the depth to the seasonal high water table is over 1.8 meters (6 feet). Permeability is slow or moderately slow, shrink-swell potential is high or moderate and the frost action potential is moderate. Typically these soils are neutral or mildly alkaline in the surface layers and mildly or moderately alkaline in the lower part.

Map Unit 59. ARGIC CRYOBOROLLS, CRYIC PALEBOROLLS, loamy, nearly level to moderately steep.

This map unit if found in Moffat, Rio Blanco, and Routt counties. The soils are formed in materials weathered in place from sandstone and shale. Argic Cryoborolls make up about 40 percent of this map unit, and Cryic Paleborolls about 50 percent. The remaining 10 percent is composed of soils with less well developed subsoils, some sandy soils and some clayey soils, and small areas of rock outcrop.

Argic Cryoborolls: These are moderately deep to deep, well drained, dark colored, loamy soils usually containing <35 percent rock fragments but sometimes will contain up to 85 percent. They are nearly level to moderately steep soils of the high mountains and occur on valley sideslopes, ridge crests, and alluvial fans and have slopes of 0 to 30 or more percent. Depth to bedrock is usually between 51 to 152 cm (20 to 60 in.), but is deeper than this in some areas. Permeability, and the shrink-swell and the frost action potential are generally moderate. Typically, these soils have neutral surface layers grading to moderately alkaline in the lower part.

Cryic Paleborolls: These deep dark colored, well drained, loamy soils usually contain <35 percent rock fragments. They are on nearly level to moderately steep mountain slopes, ridge crests, and alluvial fans, and have slopes of 0 to 30 or more percent. Depth to bedrock is usually >152 cm (60 in.), but maybe within 102 cm (40 in.) in some areas. Depth to the seasonal high water table is >1.8 meters (6 feet). Permeability and shrink-swell potential is generally moderate, and the frost action potential is moderate to high. Typically, these soils are neutral to mildly alkaline in the surface layers and neutral to moderately alkaline in the lower part.

Map Unit 60. ARIDIC HAPLOBOROLLS, TORRIORTHENTIC HAPLOBOROLLS, ARIDIC ARGIBOROLLS, clayey, gently sloping to steep.

This map unit is widely distributed in Rio Blanco and Garfield counties. The soils are formed in materials weathered in place from sandstone and shale. Aridic Haploborolls make up about 15 percent of this map unit, Torriorthentic Haploborolls about 20 percent and Aridic Argiborolls about 25 percent. The remaining 40 percent of this unit is composed of similar soils having light colored surface layers and support grasstype vegetation; light colored soils support woodlands; soils with high lime layers (calcic horizon); alluvial soils along streams; and some areas at the lower elevations which have a slightly longer growing season.

Aridic Haploborolls and Torriorthentic Haploborolls: These soils are quite similar and will be grouped together for this description. These are deep and moderately deep, dark colored, well drained, loamy soils usually containing <35 percent rock fragments, but areas having a higher percentage are included. They are on gently sloping to steep uplands, old alluvial fans and terraces, and have slopes ranging from 2 to 30 or more percent. Depth to bedrock ranges from 51 to >152 cm (20 to >60 in.), and depth to the seasonal high water table is over 1.8 meters (6 feet). Permeability is moderate, and the shrink-swell potential and frost action potential is low to moderate. Typically these soils are neutral to mildly alkaline in the surface layers and mildly or moderately alkaline in the lower part.

Aridic Haploborolls: These moderately deep to deep, dark colored well drained, clayey soils usually contain <35 percent rock fragments. They are on gently sloping to steep uplands, alluvial fans and terraces, and have slopes of 2 to 30 or more percent. Depth to bedrock ranges from

51 to 152 or more cm (20 to 60 in.), and depth to the seasonal high water table is over 1.8 meters (6 feet). Permeability is slow, the shrink-swell potential is high, and the frost action potential is low. Typically these soils have neutral to mildly alkaline surface layers and are mildly or moderately alkaline in the lower part.

Map Unit 62. TYPIC PALEBOROLLS, BOROLLIC CAMBORTHIDS, clay, gently sloping to moderately steep.

This map unit is in south central Routt county. The soils are formed in materials weathered in place from soft shale. Typic Paleborolls make up about 35 percent of this map unit, and Borollic Camborthids about 50 percent. The remaining 15 percent is composed of similar soils which are < 51 cm (20 in.) to bedrock and soils which have loamy textures.

Typic Paleborolls: These deep, dark colored, well drained clayey soils usually contain < 35 percent rock fragments. They are on gently sloping to moderately steep uplands, and have slopes of 2 to about 30 percent. Depth to rippalbe bedrock is 102 to over 152 cm (40 to over 60 in.), and depth to the seasonal high water table is over 1.8 meters (6 feet). Permeability is slow and the shrink-swell and frost action potential is high. Typically, these soils have slightly acid to neutral surface layers and are mildly or moderately alkaline in the lower part.

Borollic Camorthids: These moderately deep to deep, light colored, well drained, clayey soils usually contain < 35 percent rock fragments. They are on gently sloping to moderately steep uplands dominated by the underlying soft sedimentary bedrock, and have slopes of 2 to about 30 percent. Depth to rippable bedrock ranges from 51 to 102 or more cm (20 to 40 in.) and depth to the seasonal high water is over 1.8 meters (6 feet). Permeability is low, shrink-swell potential is high, and the frost action potential is moderate. Typically, these soils are mildly alkaline in the upper layers and moderately or strongly alkaline in the lower part.

CHAPTER III

METHODS AND PROCEDURES

Morphological Description of the Soils Studied

Profile Description

The profile description of the soils investigated are given in Appendix Table A-1. Profile descriptions were made according to standard procedures followed by the Soil Conservation Service in the National Cooperative Soil Survey program.

Site Description

Site description data are given in Appendix Table A-2. The type of parent material, topographic features such as physiography, relief, elevation, slope percent, and aspect were measured and listed. Slope percent was measured with an Abeny level. Elevation was either read from U.S. Geological Survey Topographic Maps or measured with an altimeter. Dominant native vegetation or crop for each site was identified and listed by personnel of the Soil Conservation Service. Annual precipitation in inches was either read for each site from the annual precipitation map of Colorado, or was obtained from records of nearest weather stations.

Classification

All soils studied were classified according to the United States Soil Taxonomic classification. The full taxonomic classification for each soil studied is given in Appendix Table A-3. The taxonomic classification was made based on field and supporting laboratory data.

Sample Procedure

Field Sampling

Two different samples were collected from each described soil horizon for laboratory analysis. One sample of approximately 500 grams of soil was taken for trace elements analysis. In the collection of these soil samples, contamination with any source for elements under study was carefully avoided. Another sample of approximately 2000 grams was taken from each described soil horizon for physical and chemical analysis. Before samples were taken, all horizons of a profile were cleaned to remove all loose soil, roots, and rocks that may have accumulated on the horizons while digging the soil pit. This cleaning process also revealed the structure of the soil, the rooting depth, and made for easier identification of horizon boundaries. Photographs were then taken of each soil profile. Photographs were also taken to show the landscape and associated vegetation for each soil. Soil samples were taken starting from the bottom to the top horizon, using a small plastic scoop. This procedure prevented contamination from upper horizons. All soil samples were placed in heavy plastic bags and stored in ice cream cartons until ready for use.

During sampling, the percentage by volume of rock fragments >75 mm

(3 in.) was estimated in the field for each soil horizon. Also the percentages of material >19 mm (3/4 in.) and <75 mm (3 in.) in average diameter were determined by weighing in the field. Only soil material <19 mm (3/4 in.) were brought to the laboratory for physical and chemical analysis except for those samples used for trace elements analysis which contained all different sizes of soil and geologic materials found in each respective horizon.

Sample Preparation

Soil samples used for physical and chemical analysis were air dried, lightly ground, and sieved through a 2 mm stainless steel screen. The percentages of material >2 mm and <19 mm (3/4 in.) in average diameter were determined by weighing. Approximately 100 grams of <2 mm soil material was subsampled and submitted to Colorado State University's Soil Testing Laboratory for physical and chemical analysis.

In the preparation of the soil samples for trace elements analysis, contamination with any source of the elements under study was carefully avoided. After the soil samples were air dried, two subsamples were taken. The first subsamples were lightly crushed in an agate mortor and passed through a 2 mm stainless steel sieve. These subsamples were prepared for hotwater soluble Boron and DTPA extractable Zn, Fe, Mn and Cu determinations. The second subsamples were ground in an agate mortor and all of the subsamples was passed through a 60 mesh stainless steel sieve. These subsamples were prepared for the determination of total Fe, Mn, Cu, Zn, Cd, Pb, Hg, Se, As, and Mo.

Laboratory Analysis

Physical and Chemical Analysis

Particle size distribution on the <2 mm soil material was determined by the pipette method as described in Soil Survey Investigation Report No. 1 (Soil Conservation Service, USDA 1962). Results of the particle size analysis are shown in Appendix Table A-4. The sand fractions were separated into finer sub-fractions by dry sieving. Particle size fractions were expressed as a percentage of the total <2 mm soil material. The following treatments were made on the soil samples to obtain a satisfactory dispersion of the soil particles: Dissolution of carbonates and soluble salts including gypsum with 0.5 N HCl and 1 N sodium acetate buffered at pH 4.8. This was followed by peroxidation to remove the organic matter using 30% hydrogen peroxide (Kunze 1965).

In addition to the particle size distribution analysis several other physical and chemical analysis were carried out. The following determinations were made on the soil samples using procedures as outlined in Agriculture Handbook No. 60 (U.S. Salinity Laboratory Staff 1954): Water soluble cations and anions; ammonium acetate extractable cations; cation exchange capacity; conductivity of saturation extract; pH of soil paste; lime, gypsum; 1/3 bar, 15 bar, and moisture saturation percentage.

The following modifications of the above procedures were made: The

concentration of Ca and Mg were determined in solutions by Atomic Absorption. Sulfate anions in solution were made colorimetrically as described by the method of Van der way (1965), and finally chloride anions in solution were determined using a Cl electrode.

The percentage of organic matter was determined as described by Bremmer (1965).

Available phosphorus was determined on the soil samples as described by Watanabe and Olsen (1965).

Available potassium was determined by extracting 5 grams of soil with 25 ml of 1N ammonium acatate for five minutes. The extract was then refiltered and read on the flame photometer (Pratt 1965).

The DTPA method was used to determine available Zn, Fe, Mn and Cu. Ten grams of soil were shaken with 20 ml of extracting solution for two hours and filtered. The Atomic Absorption Sepcrophotometer was used to determine the concentration of Zn, Fe, Mn, and Cu in the extracts.

Hot water soluble Boron was determined on the soil samples as described by Wear (1965).

Total of Zn, Fe, Cu and Mn were determined by weighing one gram of the 60-mesh soil sample into a Teflon beaker and adding the following reagents: 10 ml of HNO_3, 10 ml of HF (let stand overnight), and 5 ml of $HClO_4$ with 3 drops H_2SO_4 (digest and fume to moist dryness). After standing one hour the residue was brought to a 100-ml volume with deionized water. Total Zn, Fe, Cu, and Mn were then determined in solution by Atomic Absorption Spectrophotometer (Follett 1969).

Total Mo was determined by digesting the soil as described under total Zn, Fe and Cu and then adding 5 ml of 5% Ascorbic acid to the total digest, and then adjusting the pH to 2.0-2.4. The solution was transferred to a 200-ml separatory funnel and 3 ml MIBK-Oxime mixture was added and shaken for 15 min. The organic phase was then separated and the Mo content was determined using the Nitrous oxide, Acetylene method by Atomic Absorption (Chau and Lum-shee Chou 1969).

Total Hg was determined in solution obtained after extraction of the soil with concentrated nitric and perchloric acid. Total Hg content was determined in solution by flameless atomic absorption.

Total Cd and Pb were brought to solution by extraction with concentrated nitric acid. Using the tantalum ribbon technique of micro-thermal atomization, 10 microliters of sample was applied on the ribbon to determine concentration of Cd and Pb in solution (Seeley, et al 1972).

Total Se and As were determined in solution obtained after extraction with concentrated HNO_3, H_2SO_4, and $HClO_4$ acids. Total Se and As were determined in solution by the Hydride Evolution Atomic Absorption Method as described by Van Loon and Brooker (1974) and Ludmilla and Parks.

Engineering properties of the soils studied were estimated and are shown in Appendix Table A-7.

CHAPTER IV

SUMMARY OF FIELD AND LABORATORY RESULTS

This chapter includes a brief summary of the field and laboratory results. The discussion is directed mainly toward an identification and evaluation of those soil properties and/or characteristics which are most restrictive and/or beneficial to the revegetation and stabilization of disturbed lands. This study represents the most comprehensive soil characterization analysis available for this region.

Soil Classification

Soil classification is an important aspect of soil characterization studies. Through classification we are able to organize our knowledge about soils to help us relate one soil to another, and understand what changes in chemical and physical characteristics occur during soil development which in turn can help develop principles of soil behaviour and management. In addition, soil classification allows man to develop maps which show the nature, extent and distribution of soils, all of which are critical parts of developing soil management plans. Soil classification is essential for assessing the "state" of the soil environment. Without soil classification the knowledge of soils gained through scientific investigation and experience, cannot be passed on and utilized.

The 36 soils investigated in this study represent 4 of the 10 soil orders recognized in the U.S. Soil Taxonomic Classification System. These are the Mollisol, Aridisol, Entisol, and Alfisol orders. A complete taxonomic classification of the soils studied is presented in Appendix Table A-3. The photographs shown in Figures 4 through 13 represent typical profiles and associated landscape conditions of the soils most commonly found.

The morphological descriptions shown in Appendix Table A-1 reflect the variability in thickness, kind and arrangement of soil horizons. The data show that the color, texture and structure of the different horizons is quite different within a given soil and between soils. From the morphological and classification data shown, it is apparent that the basic nature of many of the soils studied has been altered by varying degrees dependent on the environmental conditions such as parent material, elevation, slope, aspect, etc.

The soil names, in many cases, reflect some important soil-plant relationships. For example, the presence of the term "Torri" indicates that the soil is dry in all horizons or depths during most of the growing season. The term "aqua" indicates a wet soil. The term "bor" indicates a soil which is cold and thus infers the type of environment under which plants must be grown. The term "argi" indicates a secondary accumulation of clay in the subsoil. The term "natr" indicates the presence of sodium.

An interpretation of the soil taxonomic names can provide key information with respect to the properties and behaviour of soils under use and management. In addition, factors such as leaching and weathering intensity can be inferred. Persons who are involved in the development of land management plans are encouraged to consult the "Soil Taxonomy", published by the Soil Conservation Service, USDA, for obtaining a better understanding of soil characteristics.

Laboratory Analysis

Soil Salinity

Salinity evaluations are based essentially on the salinity classes developed by the U.S. Salinity Laboratory. Classes are differentiated based on the electrical conductivity of the saturation extract in mmhos/cm. The classes are: none to slight, 0-4; moderate, 4-8; strong, 8-16; very strong, 16 or greater. Evaluated according to horizons, 91% of B2 horizon materials, 75% of B3 horizon materials, and 68% of C, Cr and CR materials are classed as "none to slight". Twenty-two percent of the C materials are classed as "strongly" saline and 6% "very strongly saline".

Soils in which higher levels of salinity are found are developed principally in alluvium from shale, shale and loess materials.

Sodium

Sodium levels of the soils are evaluated based on sodium hazard as reflected by exchangeable sodium percentage. The classes used are: 0 to 5% ESP, none; 6 to 15% ESP, slight to moderate; and 15% or greater, high. Evaluating the soils according to horizons, 86% of A horizon materials, 100% of B1 horizon materials, 77% of B2 horizon materials, 72% of B3 horizon materials and 45% of C horizon materials are classed as "none". Seven percent of A horizon materials, 0% of the B1 horizon materials, 11% of B2 horizon materials, 5% of the B3 horizon materials and 23% of the C materials are classed as "slight to moderate". Seven percent of A horizon materials, none of the B1 materials, 12% of the B2 horizon materials, 23% of B3 materials and 32% of the C materials are classed as "high".

The data show that high sodium levels are present in the subsurface and parent materials of soils developed from various parent materials. Ex: aluvium, loess, and shale. The sodium classes shown here are not those typically used to classify sodic soils. Typically, 15% ESP is used as a minimum for classification as a sodic soil. However, there is some evidence that sodium levels less than this amount can cause deterioration of soil physical condition in some soils. Soils containing 6 to 15% exchangeable sodium warrant further investigation. A significant number of the soil samples analyzed fall into this category.

Organic Matter

Evaluation of organic matter levels are made based on the following classes: 0 to 1.0%, low; 1.1 to 3.0%, medium; 3.1% to 10%, high; 10% or more, very high. The amount of organic matter is directly and/or

indirectly associated with inherent nitrogen fertility of the soil, soil structural stability, water holding capacity and overall general fertility. Soils low in organic matter generally have a low structural stability. Low structural stability is critical because soil aggregates cannot withstand the impact of rain and effects of tillage. The breakdown of soil aggregates can cause problems associated with erosion and affects porosity which in turn affects water and air movement in the soil.

Evaluating the organic matter status of the soils based on the classes described; 7, 46, 43, and 4% of the A horizon materials are classed in the "low", "moderate", "high" and "very high" categories, respectively, indicating that most of these materials are well suited as plant growth media from the standpoint of organic matter. About 50% of the B1 materials are classed as "moderate" and "high" with approximately 42% of the B2 materials falling in these categories and remaining 58% classed as "low". Approximately 60% of the B3 and 75% of the C materials are classed as "low". The data show that a large number of subsoil and parent materials are quite low in organic matter - a point which needs to be considered when evaluating soils for plant growth material, particularly if used as surface materials.

Available Phosphorus Status

Evaluation for phosphorus is based primarily on criteria used for assessing the plant availability of phosphorus for agronomic crops. The following two categories are identified: 0-7 ppm Bicarbonate extractable P, low; 7 ppm or more, non-deficient. Thirty-two, 85, 79, 89 and 70% of the A, B1, B2, B3, and C materials respectively are classed as low in available phosphorus, showing that phosphorus is potentially deficient in a large number of subsoil and parent materials.

Hot Water Soluble Boron

Evaluation of boron whould be considered both from the standpoint of plant deficiency and toxicity. However, criteria for evaluating boron deficiencies and/or toxicities from chemical soil tests are not very well defined, particularly for native type vegetation. The data show that only about 1% of all soil samples studied contain more than 2.0 ppm hot-water soluble boron. Based on available information regarding boron toxicity, it appears that boron would have to be at least this high or higher before becoming a problem.

Plant Available Iron - DTPA Extractable

Plant available iron was evaluated based on criteria used for agronomic crops. Soils containing 1.5 ppm or less of DTPA extractable iron are considered potentially low in available iron. Those containing more than this amount are considered as non-iron deficient soils. Using these classes, the data show that only about 1% of all soil samples analyzed could be considered as potentially deficient in plant available iron.

Plant Available Zinc - DTPA Extractable

Plant available zinc was evaluated using two categories based on the amount "DTPA Extractable Zinc". Soils containing 0.5 ppm DTPA

extractable zinc are considered as potentially deficient. Those with greater than this amount are considered non-deficient. Using these criteria, the data indicate that 55, 71, 91, 94 and 83 percent of the A, B1, B2, B3 and C horizon materials, respectively, fall into the potentially deficient category. However, it is very doubtful that zinc deficiencies would be as common as these data might suggest. On the other hand, it is perhaps a factor that should be recognized as a potential plant nutrient problem. It is important to note that the critical value of 0.5 ppm as used here applies to zinc-sensitive agronomic crops, basically corn and sorghum.

Plant Available Potassium

The plant availability of potassium as predicted by the ammonium acetate extractable method is very high, not only in the surface but in most subsurface soil materials as well.

Particle Size Analysis

This analysis provides information on the textural properties of the soils studied. Percent sand, silt, clay, USDA textural class, coarse fragment content and 0, 1/3 and 15 bar moisture contents of the soils studied are shown in Appendix Table A-4.

The particle-size analyses show that the textures of the soils are quite variable both within and among the profiles studied.

From these data the following points emerge:

1. Approximately 45% of all soil horizons examined are moderately fine to fine textured, i.e., clay loams, silty clay loams, silty clays, sandy clay loams or clays. Subsoil textures (B horizons) are finer textured than surface soils (A horizons) in 19 of the 36 profiles studied. As one would expect, the soils developed from shale are fine textured, soils developed from sandstone are dominantly loams and/or sandy loams, and soils developed from loess have silt loam surface and silty clay loam subsurface horizons. Soils developed in alluvium are quite variable.

2. The data show that there is almost as much variability in 1/3 to 15 bar moisture content within some textural classes as there is among the textural classes.

3. The data reflect the high amount of coarse fragments (2mm size materials) that occur within many of the soils -- particularly those developed in sandstone. In addition the data show that coarse fragments generally increases in depth in soils where they occur. Coarse fragment content may be more beneficial than detrimental from the standpoint of erosion and soil-plant moisture relationships. They can, however, present problems from the standpoint of physically handling the material during preparation of a seed bed and during seeding activities.

In summary, most soil materials except for the silty clays, clays, loamy sands and some of the coarse sandy loams, have a high water holding capacity. Although the permeability of the fine textured material would be expected to be moderately slow, the morphological characteristics of the soils studied suggests that internal drainage of most soils is good.

The particle size analysis show that in the areas where shale predominates, subsoils are generally fine-textured. Thus problems associated with infiltration, compaction, and erosion must be considered if these materials are to be used as topsoil.

In general, this portion of the chemical data indicates that excess sodium, high salinity, low availability of phosphorus, low organic matter and low structural stability in some subsoil materials, and coarse fragment content are the soil factors that pose the most concern leading toward successful revegetation and stabilization.

Boron does not appear to be a problem associated with most of the soils studied, either from a plant deficiency or toxicity standpoint. Nitrogen deficiencies, both short-termed and long-termed might be associated with soil materials having less than 0.5% organic matter.

Soils of this region reflect a wide variety of soil textures. Subsequently, wide variations can be expected with respect to infiltration, permeability, water holding capacity, structural stability and workability of the soils investigated.

It is very important to note that the evaluations for plant nutrient availability must be interpreted with caution. These evaluations are based on soil test correlations for agronomic crops and their applicability to conditions and types of vegetation associated with mined land reclamation is not very well understood.

The data presented in this report are undergoing a more critical evaluation as part of a PhD thesis research problem. This research will be completed and published in thesis form by June, 1977.

Figure 4. Typical soil profile and associated landscape of Typic Cryoborolls--Site 14

Figure 5. Typical soil profile and associated landscape - Typic Argiborolls--Site 10

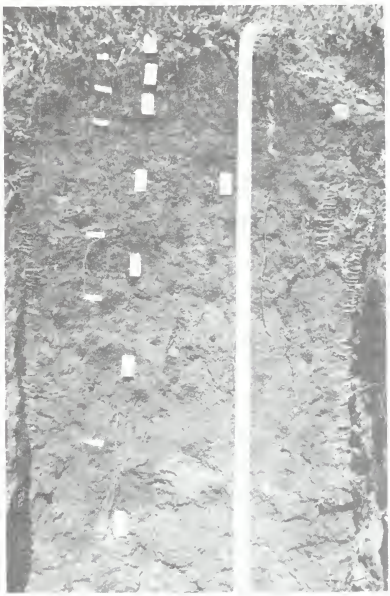


Figure 6. Typical soil profile and associated landscape - Borollic Haplargids--Site 19

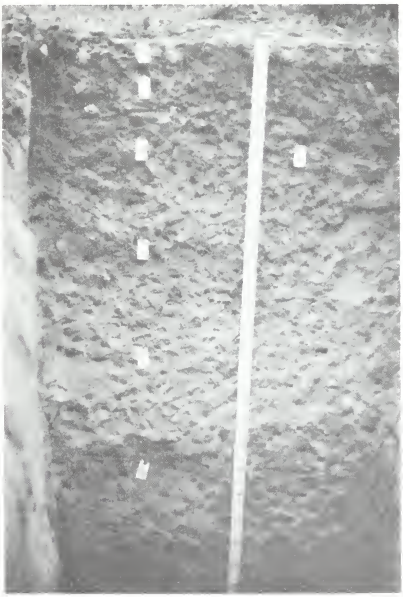


Figure 7. Typical soil profile and associated landscape - Cryic Pachic Paleborolls--Site 29

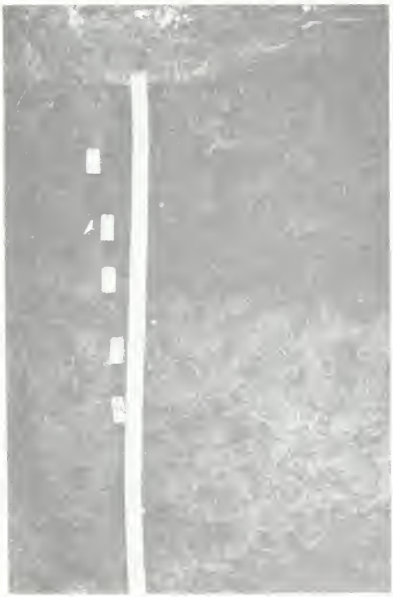


Figure 8. Typical soil profile and associated landscape - Ustic Torrifluvents--Site 21

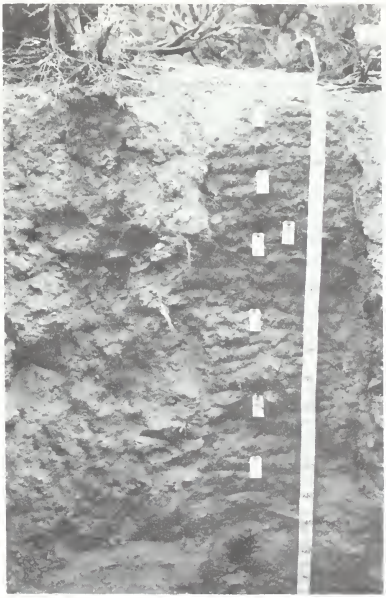


Figure 9. Typical soil profile and associated landscape - Typic Fluvaquents--Site 33

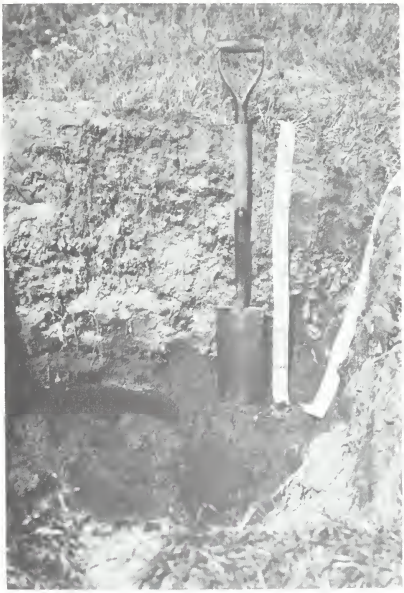
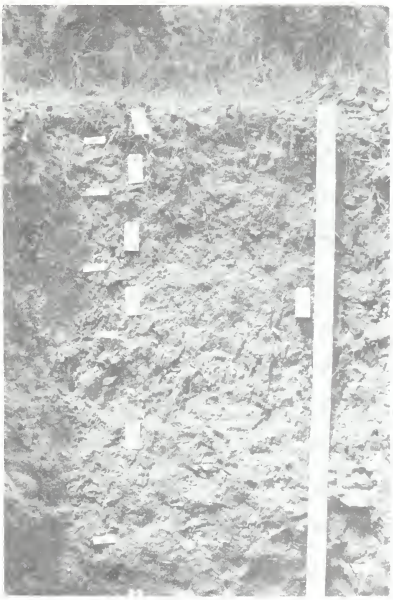


Figure 10. Typical soil profile and associated landscape - Borollic Natrargids--Site 5



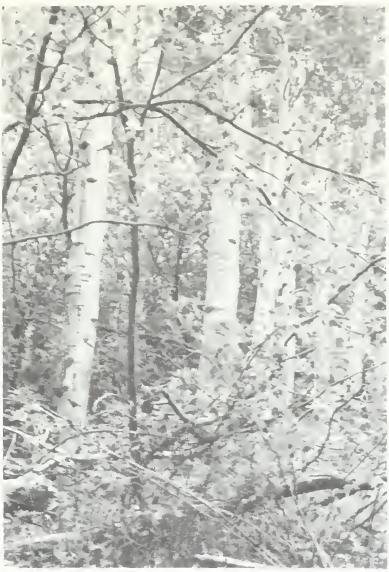


Figure 11. Typical soil profile and associated landscape - Argic Pachic Cryoborolls--Site 18

Figure 12. Typical soil profile and associated landscape - Lithic Cryoborolls--Site 17

Figure 13. Typical soil profile and associated landscape - Borollic Camborthids--Site 6

Trace Elements

Total trace element status of the soil studied

The total content of selected trace elements and other chemical and physical properties of the soils studied are presented in Appendix A. Generally, the soils studied differ widely in morphological, physical and chemical characteristics as well as in total content and distribution of trace elements. Although soils within a given great soil group or formed from a given parent material show some properties in common, there is some variation in total content and distribution of the trace elements studied. The distribution patterns of the total content of trace elements in the soils investigated can best be described by the following types of profile distribution relationships:

1) Very little variation of the concentration of the trace elements with depth in soil profile. This suggests the importance of parent material as a soil forming factor on the distribution of trace elements in soils where the intensity of soil formation is low.

2) A high concentration of some trace elements in the topsoil and a gradual decrease with depth reflecting soils where organic matter has accumulated at the surface.

3) Total trace element content is relatively uniform throughout the soil profile with only slight or moderate increase in the subsoil horizons (especially B_2t horizons). This is a reflection of the association of some trace elements with clay.

4) Surface accumulation with the lowest concentration occurring in the subsoil, then gradually increasing with depth.

5) No pattern.

Apparently, variation in parent material as well as in other local pedological factors greatly influenced the content and distribution of these trace elements. The individual trace element status in the soils study is discussed below:

Iron

The range in total Fe content for all samples analyzed was from 0.98 to 7.08 percent. The highest level was found in the IIC horizon of site No. 36. Except for this horizon which was found to be weathered limestone, all other samples had total Fe concentrations within the range of 0.98 to 4.50 percent. The total Fe content of most soils, according to Lindsay (1975), ranges from 1 to 4 percent. Soils formed from shale were found to contain the highest total Fe content, while soils formed from sandstone contained the lowest. In general, the distribution pattern of the average content of total Fe appeared to be highest at the surface (topsoil) and gradually decreased with depth. This is an indication of Fe--organic matter association.

Manganese

The range in total Mn for all samples analyzed was from 55 to 1,750 ppm. Except for three samples which contain 1,110, 1,350, and 1,750 ppm total Mn, the remaining samples analyzed has Mn concentration within the range 55-840 ppm. (Appendix A). Total Mn content of most soils, according to Swaine (1955), ranges from 200 to 3,000 ppm. Follett (1969) in his study on Zn, Fe, Mn, and Cu in Colorado Soils found the total Mn content of 37 major benchmark soil profiles range from 68 to 1,340 ppm. In the soils studied, the average content of total Mn appeared to be relatively uniform throughout the soil profile with some accumulation in the topsoil. This indicates that total amount Mn found in the soil profile is largely dependent upon the amount of Mn found in the parent material with some modification caused by the accumulation of organic matter in the topsoil. This pattern of distribution was changed when soils were arranged according to their soil parent material. The average content of total Mn appear to be highest at the surface and gradually decreases with depth except for the soils formed from sandstone where the average content of total Mn was higher in the parent material than in the solum. Soils formed from Uinta sandstone appear to contain the highest amount of total Mn (1750 ppm) with other sandstones containing far lower amounts.

Total Mn distribution appears to follow the same pattern as total Fe, Zn, Cu and Cd. There appears to be no relationship of total Mn with total As and Mo, Se, Hg, and Pb distribution. Total Mn appears to be highly correlated with organic matter, cation exchange capacity and total Mn in the parent material. There appears to be no correlation of total Mn with pH and clay content, lime, sand, silt, and the amount of salts found in the soil profile.

Zinc

The range in total Zn for all samples analyzed was from 30 to 217 ppm. (Appendix A). Some of the highest Zn contents were found in soils formed from shale while soils formed from the sandstone or loess contain the lowest values. Normal soils contain from 10 to 300 ppm (Swaine 1955). Follett (1969) gave the range in the Zn content of Colorado soils as 8 to 148 ppm. The average content of total Zn appeared to be relatively uniform throughout the soil profile with only a slight increase in the topsoil and moderate increase in the subsoil. There was tendency for total Zn to increase in B horizons having an accumulation of clay. Also, there is an indication of a Zn-organic matter association in the topsoil when soils are arranged according to their parent material. The data obtained may lead to the conclusion that pedological factors other than parent material have a strong influence in determining the accumulation, translocation or reorganization of Zn within the soil profiles.

Total Zn content appears to be positively associated with total Fe, Mn, Cu, Cd, Hg, As, Se, and Mo.

Copper

Total Cu content ranged from 2 to 72 ppm (Appendix A). As in the case of Fe and Zn, the highest total Cu content was found in soils formed from shale while the lowest Cu values were found in soil formed from sandstone.

Normal soils contain from 2 to 100 ppm (Swaine 1955). Follett (1969) gave the range in the Cu content of Colorado soils as 2 to 92 ppm. The distribution of the total Cu was quite similar to that of the average content of total Zn. Also, the distribution patterns of the average content of total Cu was similar to that of Zn when soils are arranged according to their parent material. Total Cu distribution appears to be related closely to total Fe, Mn, Zn, Cd, Hg, As and Mo distribution. Principal soil characteristics which appear to be closely related to Cu distribution are clay content, silt, organic matter, CEC and total content of Cu in the parent material and no particular relationship with pH and lime.

Arsenic

The total As content in the soils examined was found to be less than 18 ppm (Appendix A), and mostly in the range of 2.5 to 17.5 ppm. Normal soils contain from 1 to 50 ppm of As, with the content of most soils less than 10 ppm (Swaine 1955). The average content of total As appeared to be relatively uniform throughout the soil profile with some accumulation in both topsoil and subsoil.

The results suggest that the predominant factors involved in the As distribution are the As content of parent material, total Fe content, in that order, where the total Fe content might reflect the association of As with Fe oxides in the soil studied. Clay and organic matter appear to have little or no influence on the As distribution. This might suggest that the Fe oxides which are associated with As are of larger size than the clay fraction. Therefore, pedogenic processes in the soil profiles studied have had no or very little influence on the distribution of As.

Lead

The total Pb content in the soils studied was found to be less than 10 ppm (Appendix A), and mostly in the range of 1.16 to 9.65 ppm. Most soils have a total of 2 to 200 ppm Pb with an average concentration of 30 ppm (Swaine 1955, Bowen 1966). The soils studied thus contain comparatively low quantities of this element. In general, the average total Pb content appeared to be quite uniform throughout the soil profile and did not accumulate either in the topsoil or subsoil. When soils were arranged according to their parent material, the distribution pattern remained the same in soils formed from sandstone and shale.

Molybdenum

The range in total Mo content for all samples analyzed was from .01 to 1.52 ppm (Appendix A). According to Swaine (1955), the total content of Mo of most of the soils in the world ranges from .2 to 5 ppm with an approximate mean of 1 ppm. Only four soil profiles contain horizons that have total Mo levels of greater than 1 ppm. These are soils mostly formed from shale. The rest of the soils studied thus contain relatively low quantities of this element. In general, the average total Mo content appeared to be quite uniform throughout the soil profile and did not accumulate either in the topsoil or in the subsoil for the various combinations of soil groupings. This indicated that total amount of Mo found in a soil profile was largely dependent upon the amount of Mo found in the parent material.

On the other hand, there was a tendency for total Mo to accumulate in the B horizon of soils at Sites 6, 10, 36 and 7. The first site is a Camborthid and the last three are Cryoborolls. These results indicate that the predominant factor involved with total Mo is the parent material. They also might suggest that the slight accumulation of Mo in the subsoil of some soil profiles is due to the migration of the organic matter into the subsoil of which Mo was a part.

Selenium

The total Se content in the soils analyzed was found to be less than 1 ppm (Appendix A), and mostly in the range of .01 to .85 ppm. The total content of Se of the soils in the world ranges from .1 to 2 ppm (Swaine 1955). Soils formed from shale were found to contain the highest total Se, while soils formed from sandstone contain the lowest. In general, the average total Se content appeared to be quite uniform throughout the soil profile with a slight accumulation in the subsoil. When soils are arranged according to their parent material the distribution pattern is as follows: 1) relatively uniform throughout the soil profile in soils formed from sandstone and loess, 2) highest at the surface and gradually decreasing with depth in soils formed from shale and sandstone, mixed, and 3) increases gradually with depth in soils formed from shale.

These results might suggest the following: 1) the parent material is the major factor contributing to the content and distribution of Se in the soils studied, 2) the Se content was associated more with the silt fraction content of the soil than with the clay, 3) organic matter and clay content did not contribute anything to the variation of Se in the soils studied, and finally 4) water soluble Se is the only form that can translocate and it moves and accumulates similarly to the other soluble salts in the soil profile.

Cadmium

The total Cd content in the soils studied was found to be less than 0.6 ppm (Appendix A). According to Bowen (1966) the total content of Cd of most of the soils ranges from .01 to 7 ppm. It is unlikely that normal soils would contain more than 1 ppm (Swaine 1955). The distribution pattern of the average content of Cd appeared to decrease gradually with depth. When soils are compared according to their parent material, the distribution pattern is similar to the above only in soils formed from sandstone and mixed shale and sandstone. In soils formed from shale these appeared to be a surface accumulation with the least concentration in the subsoil, then increase with depth while in soils formed from loess the concentration of the average total Cd was higher in the parent material than in the solum.

From these results one might conclude that the predominant factors involved in the Cd distribution in the soils studied are the content of Cd in the parent material, organic matter content of the upper horizons, and the amount of salts found in the subsoil and parent material; in that order of importance. The lack of association of the clay content with total Cd in the subsoil but not in the topsoil and parent material might suggest that the translocation and the slight accumulation of total Cd in some soil profiles does correlate with translocation and/or accumulation of clay fraction but with the organic matter and various types of salts; Cd being a part of these constituents.

Mercury

The range in total Hg for all samples analyzed was from .013 to .112 ppm (Appendix A). In an extensive analytical survey of over 900 soil samples from throughout the United States, Shocklettle et al. (1971) reported a range of .01-3.4 and .01-4.6 ppm of Hg for the eastern and western sections, respectively. In about 40% of the soils studied, the highest Hg concentrations were in the parent material. For a few profiles, however, the highest Hg concentrations were found in horizons of clay or organic matter accumulation, and in some others the Hg concentrations were similar in all horizons. The distribution pattern of the average total Hg content of all the soils studied appears to be uniform throughout the soil profile with the lowest concentration in the surface soil. In soils formed from shale and mixed shale and sandstone, the average total content of Hg increases with depth. In contrast, the average total content of Hg in soils formed from sandstone or loess was a little higher in the solum than in the parent material.

General Discussion

The means and the ranges of trace element contents of the soils studied tend to fall within the range of the trace element contents for the normal soils found in different parts of the world with the exception of total Pb, Mo and Se which were slightly lower. Soils formed from shale, as expected, were found to contain the highest total trace contents while soils formed from sandstone containing the lowest. There was one exception, that being a soil formed from Uinta Sandstone, which contained the highest Mn concentration in all the soils studied (see site No. 20). Taking each horizon as an independent individual sample without reference to profile, all the trace elements studied show a correlation with the clay content, organic matter, pH and lime, with the exception of the following: 1) Pb with clay content, 2) As and Hg with organic matter, 3) Pb and Mo with pH, and 4) Mn, Pb, Mo, Se, and Hg with lime content.

Manganese, which is reported in the geochemical literature as being associated with other trace elements, appeared to have some association with Zn, Cu, As, Se and Mo.

The pH of the soil paste was a major factor associated with distribution of Hg and also was an important factor associated with Fe and Mn. Soil pH appeared to be a minor factor associated with Zn, Cu, As, Mo, Se and Cd. Finally, the conductivity of the saturation extract had some association with only Se and Cd.

The variation between horizons in a profile were further examined, using all horizons of each profile, and the coefficient of variation* calculated. These are shown in the following table. From the coefficient of variation, it is seen that Se, Cd and Mo are more variable than the other elements. The variability within profiles may be taken to a certain degree as a measure of the mobility of the elements in that profile, i.e., the ease with which the elements may be moved from one horizon to another by the soil-forming processes which are dominant in the environment under which the soils studied are being formed.

Coefficient of Variation Due to Within Profile Variation

Element	Coefficient of Variation* %
Se	98.9
Cd	84.2
Mo	82.1
Hg	60.6
Cu	52.1
Mn	51.7
Pb	37.6
As	36.6
Zn	34.2
Fe	29.5

It is interesting to note that most variable two elements, Se and Cd, were also the only two elements associated with the amount of salts found in soil profile. The movement of Fe may be obscured by the presence of relatively large amounts of unweathered Fe, or by insoluble oxides.

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*coefficient of variation = $\frac{\text{The Standard Deviation}}{\text{Mean}} \times 100$

The close relationship between parent material and the soil derived from it implies that the potential trace element supplying power of a soil would considerably be influenced by the nature and content of the parent material and it becomes apparent that an insight into this relationship is of considerable practical importance, recognizing the increasing important role trace elements play both in plant and animal nutrition. The results also suggest that pedogenic factors other than parent material have some influence on the distribution, accumulation, or reorganization of trace element content of a soil, but it gives no information either on the factors involved or on their effect. The data suggest that the intensity of soil formation in the soils studied is not of sufficient magnitude to alter the trace element distribution in these profiles significantly.

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APPENDIX A

SITE #1

Location: Northeast quarter of Southeast quarter of Sec. 9, T2N, R92W, Rio Blanco County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A11	0-18	Very dark brown-black (10YR 2/1.5) moist; silty clay loam, stone fragments make up 5% by volume of total soil mass, dark gray (10YR 4/1) dry; moderate very fine granular; very friable when moist, soft when dry, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.7; clear smooth boundary.
A12	18-64	Very dark brown-black (10YR 2/1.5) moist; silty clay loam, stone fragments make up 5% by volume of total soil mass, dark gray (10YR 4/1) dry; moderate very fine granular; very friable when moist, soft when dry, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.9; clear wavy boundary.
A2	64-71	Pale brown (10YR 6/3) moist; silt loam, stone fragments make up 20% by volume of total soil mass; light brownish gray (10YR 6/2) dry; weak medium subangular blocky; friable when moist, hard when dry, sticky and plastic when wet; noncalcareous; pH 7.0; clear wavy boundary.
B&A	71-99	Brown (10YR 5/3) moist; silty clay loam (34% clay est.); flag fragments make up 50% by volume of total soil mass; very pale brown (10YR 7/3) dry; moderate coarse subangular blocky to strong medium subangular blocky; firm when moist, extremely hard when dry, sticky and plastic when wet; noncalcareous; pH 6.8; gradual wavy boundary.
B2t	99-130	Pale brown (10YR 6/3) moist; silty clay (50% clay est.), flag fragments make up 50% by volume of total soil mass; very pale brown (10YR 7/3) dry; moderate coarse subangular blocky to moderate medium subangular blocky; firm when moist, extremely hard when dry, very sticky and very plastic when wet; noncalcareous; pH 6.0; gradual smooth boundary.
C	130-180	Light yellowish brown (10YR 6/4) moist; silty clay (50% clay est.); flag fragments make up 50% by volume of total soil mass; very pale brown (10YR 7/4) dry; weak very coarse subangular blocky; firm when moist, extremely hard when dry, very sticky and very plastic when wet; noncalcareous; pH 5.4.

Appendix Table A-1. Morphological characterization and location of the soils studied.

SITE #2

Location: Southwest quarter of Southwest quarter of Sec. 9, T2N, R92W, Rio Blanco County, Colorado

Soil Profile:

Horizon	Depth (cm)	Description
A11	0-25	Black to very dark brown (10YR 2/1.5) moist; loam; dark gray (10YR 4/1) dry weak fine subangular blocky; very friable when moist, soft when dry, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.8; clear smooth boundary.
A12	25-48	Black to very dark brown (10YR 2/1.5) moist; clay loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky; very firm when moist, soft when dry, slightly sticky and slightly plastic when wet; noncalcareous; pH 7.1; clear wavy boundary.
A13	48-94	Very dark brown (10YR 2/2) moist; clay loam; dark gray (10 YR 4/1) dry; moderate fine subangular blocky to moderate fine granular; very firm when moist, slightly hard when dry, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.8; clear wavy boundary.
B2	94-119	Strong brown (7.5YR 5/6) moist; clay loam (32% clay est.); pink (7.5YR 7/4) dry; weak coarse subangular blocky to weak medium subangular blocky; firm when moist, very hard when dry, sticky and plastic when wet; noncalcareous; pH 6.5; clear wavy boundary.
C	119-132	Strong brown (7.5YR 5/6) moist; clay loam (32% clay est.); pink (7.5YR 7/4) dry; weak coarse subangular blocky to weak medium subangular blocky; firm when moist, very hard when dry; sticky and plastic when wet; noncalcareous; pH 6.6.

Appendix Table A-1. (Continued)

SITE #3

Location: Northeast quarter of Southwest quarter of Sec. 16, T4N, R93W, Moffat County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-12	Dark brown (7.5YR 4/2) moist loam; brown (7.5YR 5/4) dry; weak fine granular; very friable when moist, soft when dry, slightly plastic and slightly sticky when wet; noncalcareous; pH 7.8; clear smooth boundary.
B1	12-28	Dark brown (7.5YR 4/2) moist clay loam (28% clay est.); brown (7.5YR 5/2) dry; weak medium subangular blocky; firm when moist, slightly hard when dry, sticky and plastic when wet; noncalcareous; pH 7.4; clear wavy boundary.
B2t	28-58	Brown (7.5YR 5/2) moist clay loam (33% clay est.); brown (7.5YR 5/3) dry; moderate medium coarse subangular blocky; firm when moist, hard when dry, sticky and plastic when wet, noncalcareous; pH 7.3; clear wavy boundary.
B3ca	58-84	Brown (10YR 5/3) moist loam (25% clay est.); light brownish gray (10YR 6/2) dry; moderate medium subangular blocky; friable when moist, slightly hard when dry, slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.4; gradual wavy boundary.
C1ca	84-104	Grayish brown (10YR 5/2) moist loam; pale brown (10YR 6/3) dry; weak coarse subangular blocky; firm when moist, slightly hard when dry, slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.6; gradual wavy boundary.
IIC2ca	104-127	Brown (10YR 5/3) moist sandy clay loam (18% clay est.); pale brown (10YR 6/3) dry; weak coarse subangular blocky, firm when moist, slightly hard when dry, slightly sticky and plastic when wet; strongly calcareous; pH 8.7; abrupt wavy boundary.
IIC3ca	127-150	Brown (10YR 5/3) moist sandy loam (14% clay est.); pale brown (10YR 6/3) dry; structureless massive; very friable when moist, slightly hard when dry; non sticky and non plastic when wet; slightly calcareous; pH 8.8; clear irregular boundary.
IIICR	150-195	Soft shale; pH 8.9.

Appendix Table A-1. (Continued)

SITE #4

Location: Southwest quarter of Southeast quarter of Sec. 32, T5N, R93W, Moffat County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A11	0-13	Dark grayish brown (10YR 4/2) moist; silt loam (30% clay est.); light gray (10YR 7/2) dry; moderate medium platy to moderate fine granular, friable when moist, slightly hard when dry, sticky and plastic when wet; slightly calcareous; pH 8.4; clear smooth boundary.
A12	13-28	Dark grayish brown (10YR 4/2) moist; silty clay loam (30% clay est.); light brownish gray (10YR 6/2) dry; weak coarse granular to moderate medium granular; friable when moist, slightly hard when dry, sticky and plastic when wet; slightly calcareous; pH 8.5; clear smooth boundary.
B2	28-56	Dark grayish brown (10YR 4/2) moist; silty clay loam (32% clay est.); pale brown (10YR 6/3) dry; moderate medium subangular blocky; friable when moist, hard when dry, sticky and plastic when wet; strongly calcareous; pH 8.6; clear smooth boundary.
B3ca	56-82	Brown (10YR 5/3) moist; silty clay loam (36% clay est.); pale brown (10YR 6/3) dry; weak to moderate medium subangular blocky; friable when moist, hard when dry, sticky and plastic when wet; strongly calcareous; pH 8.3; gradual smooth boundary.
C1ca	82-134	Brown (10YR 5/3) moist; silty clay loam (33% clay est.); very pale brown (10YR 7/3) dry; weak coarse subangular blocky to weak subangular blocky; friable when moist, hard when dry, sticky and plastic when wet; strongly calcareous; pH 8.5; gradual smooth boundary.
C2ca	134-183	Light olive brown (2.5Y 5/4) moist; silty clay loam (35% clay est.); very pale brown (10YR 7/4) dry; weak coarse subangular blocky; friable when moist, hard when dry, sticky and plastic when wet; strongly calcareous; pH 8.6; gradual smooth boundary.

Appendix Table A-1. (Continued)

SITE #5

Location: Southeast quarter of Southeast quarter of Sec. 36, T5N, R54W, Moffat County, Colorado.

Soil Profile:

Horizons	Depth (cm)	Description
A21	0-10	Grayish brown (10YR 5/2) moist; clay loam (16% clay est.); light gray (10YR 7/2) dry; moderate medium platy to moderate very fine crumb; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; slightly calcareous; pH 7.9; clear smooth boundary.
A22	10-23	Brown (10YR 5/3) moist; silt loam (16% clay est.); pale brown (10YR 6/3) dry; moderate very thin platy; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; slightly calcareous; pH 8.1; clear smooth boundary.
B21t	23-43	Dark brown to brown (10YR 4/3) moist; silty clay loam (34% clay est.); pale brown (10YR 6/3) dry; weak medium subangular blocky; very hard when dry, very firm when moist, sticky and plastic when wet, slightly calcareous; pH 8.1; clear smooth boundary.
B22t	43-56	Light olive brown (2.5Y 5/4) moist; silty clay loam 18% clay est.); light brownish gray (2.5Y 6/2) dry; moderate medium prismatic to moderate medium angular blocky; extremely hard when dry, very firm when moist, very sticky and very plastic when wet; slightly calcareous; pH 8.5; clear smooth boundary.
B23sa	56-112	Light olive brown (2.5Y 5/4) moist; clay loam (38% clay est.); light brownish gray (2.5Y 6/2) dry; weak coarse prismatic to weak coarse angular blocky; extremely hard when dry, very firm when moist, very sticky and very plastic when wet; strongly calcareous; pH 8.6; clear smooth boundary.
C	112-173	Light olive brown (2.5Y 5/4) moist; silty clay loam light brownish gray (2.5Y 6/2) dry; structureless; firm when moist, very sticky and very plastic when wet; slightly calcareous; pH 8.7.

Appendix Table A-1. (Continued)

SITE #6

Location: Northwest quarter of Southwest quarter of Sec 34, T5N, R94W, Moffat County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A11	0-5	Dark grayish brown (2.5Y 4/2) moist; silt loam (22% clay est.); light brownish gray (2.5Y 6/2) dry; moderate medium platy to moderate fine granular; very friable when moist; slightly hard when dry; slightyly sticky and slightly plastic when wet; slightly calcareous; pH 7.3; abrupt smooth boundary.
A12	5-15	Dark grayish brown (2.5Y 4/2) moist; silty clay loam (30% clay est.); grayish brown (2.5Y) dry; weak medium subangular blocky; firm when moist; hard when dry, sticky and plastic when wet; slightly calcareous; pH 7.6; clear smooth boundary.
B21	15-25	Olive (5Y 4/3) moist; silty clay loam (40% clay est.); olive (5Y 5/3) dry; weak coarse subangular blocky; very firm when moist; very hard when dry; very sticky and very plastic when wet; strongly calcareous; pH 7.4; clear smooth boundary.
B22	25-42	Olive (5Y 4/3) moist; silty clay loam (40% clay est.); light brownish gray (2.5Y 6/2) dry; weak coarse angular blocky, very firm when moist, very hard when dry; very sticky and very plastic when wet; strongly calcareous; pH 8.0; clear smooth boundary.
B3ca	42-76	Olive (5Y 5/3) moist; silty clay loam (38% clay est.); light olive gray (5Y 6/2) dry; weak coarse subangular blocky; firm when moist; very hard when dry; very sticky and very plastic when wet; violently calcareous, pH 7.9; clear boundary.
CR	76-148	Partially weathered shale; pH 8.4.

Appendix Table A-1. (Continued)

SITE #7

Location: Southwest quarter of Northeast quarter of Sec. 11, T4N, R95W, Moffat County, Colorado

Soil Profile:

Horizon	Depth (cm)	Description
A11	0-23	Very dark brown (10YR 2/2) moist; loam; dark grayish brown (10YR 4/2) dry; moderate fine granular; soft when dry, very friable when moist, slightly sticky to slightly plastic when wet; noncalcareous; pH 6.9; clear smooth boundary.
A12	23-56	Very dark brown (10YR 2/2) moist; loam, stone fragments make up 5-10% by volume of total soil mass; grayish brown (10YR 5/2) dry; moderate fine granular; soft when dry, very friable when moist, slightly plastic when wet; slightly calcareous; pH 7.3; smooth boundary.
B1	56-82	Dark grayish brown (10YR 4/2) moist; loam (26% clay est.); light brownish gray (10YR 6/2) dry; weak medium subangular blocky; slightly hard when dry, very friable when moist, sticky and plastic when wet; slightly calcareous; pH 7.5; clear wavy boundary.
B2t	82-124	Grayish brown (10YR 5/2) moist; silt loam (32% clay est.); stone fragments make up 10% by volume of total soil mass; light brownish gray (10YR 6/2) dry; moderate medium subangular blocky; hard when dry, friable when moist, sticky and plastic when wet; reaction slightly calareous; pH 7.5; clear wavy boundary.
C	124-193	Brown (19YR 5/3) moist; loam, stone fragments make up 40% by volume of total soil mass; very pale brown (10YR 7/3) dry; structureless to weak coarse subangular blocky; hard when dry, friable when moist, sticky and plastic when wet; slightly calcareous; pH 7.5; clear wavy boundary.

Appendix Table A-1. (Continued)

SITE #8

Location: Southwest quarter of Northwest quarter of Sec. 32, T6N, R91W, Moffat County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
Ap	0-25	Very dark grayish brown (10YR 3/2) moist; loam (25% clay est.); brown (10YR 5/3) dry; moderate fine granular; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; non-calcareous; pH 7.1 clear smooth boundary.
B21t	25-46	Dark brown (7.5YR 3/2) moist; clay loam (32% clay est.); brown to dark brown (7.5YR 4/2) dry, moderate fine subangular blocky; hard when dry, firm when moist, sticky and plastic when wet; non-calcareous; pH 7.3; clear smooth boundary.
IIB22tb	46-65	Brown to dark brown (7.5YR 4/4) moist; clay loam (34% clay est.) brown (7.5YR 5/4) dry; weak medium prismatic to moderate medium subangular blocky; very hard when dry, very firm when moist, sticky and plastic when wet; non-calcareous; pH 7.4; clear wavy boundary.
IIB3cab	65-91	Brown (7.5YR 5/4) moist; sandy clay loam; brown (7.5YR 5/4) dry; weak coarse prismatic to coarse subangular blocky; hard when dry, firm when moist, slightly sticky and plastic when wet; strongly calcareous; pH 8.0; gradual smooth boundary.
IIC1cab	91-162	Brown (7.5YR 5/4) moist; loam (22% clay est.); light brown (7.5YR 6/4) dry; structureless; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.0.
IIC2b	162-175	Light brown (7.5YR 6/4) moist; sandy loam; light brown (10YR 6/4) dry; structureless; hard when dry, friable when moist, nonsticky and nonplastic when wet; strongly calcareous; pH 8.1.
IIIA2b	175-190	Brown (10YR 5/3) moist; silty clay loam (20% clay est.); pale brown (10YR 7/3) dry; structureless; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; slightly calcareous; pH 8.1.

Appendix Table A-1. (Continued)

SITE #8 (continued)

IIIB2ta	190-235	Brown to dark brown (7.5YR 4/4) moist; clay loam (26% clay est.); light brown (7.5YR 6/4) dry; weak coarse subangular blocky; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; pH 8.0.
IIIC1b	235-262	Brown (7.5YR 5/4) moist; loam (20% clay est.); brown (7.5YR 5/4) dry; structureless; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.1.
IIIC2b	262-290	Brown (7.5YR 5/4) moist; loam (20% clay est.); light brown (7.5YR 6/4) dry; structureless; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous, pH 8.1.
IVC3b	290-325	Gravelly outwash. Strongly calcareous.

Appendix Table A-1. (Continued)

SITE #9

Location: Northeast quarter of Northwest quarter, Sec. 4, R90W, Moffat County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A11	0-13	Very dark brown (10YR 2/2) moist; loam (20% clay est.); dark grayish brown (10YR 4/2) dry; weak thin platy to weak very fine granular; soft when dry, very friable when moist, nonsticky and slightly plastic when wet; noncalcareous; pH 6.5; clear smooth boundary.
A12	13-36	Very dark brown (10YR 2/2) moist; loam (20% clay est.); dark grayish brown (10YR 4/2) dry; weak medium subangular blocky to weak medium-coarse granular; soft when dry, very friable when moist, nonsticky and slightly plastic when wet; noncalcareous; pH 6.2; clear smooth boundary.
B21t	36-66	Very dark gray (10YR 3/1) moist; clay loam (32% clay est.); dark grayish brown (10YR 4/2) dry; weak medium subangular blocky; hard when dry, firm when moist, sticky and plastic when wet; noncalcareous; pH 6.2; gradual smooth boundary.
B22t	66-99	Light olive brown (2.5Y 5/4) moist; clay loam (34% clay est.); light yellowish brown (2.5Y 6/4) dry; weak coarse prismatic to weak medium-coarse subangular blocky; very hard when dry, very firm when moist, very sticky and plastic when wet; noncalareous; pH 6.4; gradual wavy boundary.
C	99-117	Light olive brown (2.5Y 5/4) moist; loam (24% clay est.); light yellowish brown (2.5Y 6/4) dry; structureless massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; noncalcareous; pH 7.0; gradual smooth boundary.
CR	117-152	Soft strongly calcareous shale; pH 8.2.

Appendix Table A-1. (Continued)

SITE #10

Location: Southeast quarter of Northeast quarter of Sec. 4, T5N, R90W, Moffat County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-8	Very dark brown (10YR 2/2) moist; clay loam; dark grayish brown (10YR 4/2); moderate medium platy to moderate fine granular; friable when moist; soft when dry, slightly sticky and slightly plastic when wet; noncalcareous; pH 7.1; clear smooth boundary.
B21t	8-18	Very dark grayish brown (10YR 3/2) moist; silty clay (37% clay est.); grayish brown (10YR 5/2) dry; strong fine angular blocky; very firm when moist; very hard when dry; very sticky and very plastic when wet; noncalcareous pH 7.3, clear smooth boundary.
B22t	18-28	Very dark grayish brown (10YR 3/2) moist; clay; grayish brown (10YR 5/2 dry); moderate medium angular blocky; very firm when moist; extremely hard when dry; very sticky and very plastic when wet; noncalcareous, pH 7.2, clear smooth boundary.
B23t	28-66	Dark grayish brown (2.5Y 4/2) moist; silty clay; grayish brown (2.5Y 5/2); moderate coarse subangular blocky; very firm when moist; extremely hard when dry, very sticky and very plastic when wet; slightly calcareous; pH 7.7, clear irregular boundary.
B3	66-87	Light olive brown (2.5Y 5/4) moist; silty clay; light yellowish brown (2.5Y 6/4) dry; weak coarse subangular blocky; very firm when moist; very hard when dry; very sticky and very plastic when wet; strongly calcareous, pH 7.7, clear wavy boundary.
C	87-128	Light olive brown (2.5Y 5/4) moist; silty clay; light yellowish brown (2.5Y 6/4) dry; structureless, firm when moist; hard when dry; very sticky and slightly plastic when wet; strongly calcareous; pH 7.9, gradual smooth boundary.
CR	128-158	Soft shale; pH 7.9.

Appendix Table A-1. (Continued)

SITE #11

Location: Near center of Sec. 33, T6N, R90W, Moffat County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
O	7-0	Duff
A11	0-18	Very dark brown (10YR 2/2) moist; sandy loam; dark grayish brown (10YR 4/2) dry; weak fine granular; soft when dry, very friable when moist, nonsticky and nonplastic when wet; noncalcareous; pH 6.8; clear smooth boundary.
A12	18-36	Very dark grayish brown (10YR 3/2) moist; sandy loam; grayish brown (10YR 5/2) dry; weak fine granular; soft when dry, very friable when moist; nonsticky and nonplastic when wet; noncalcareous; pH 6.9; clear wavy boundary.
B1	36-68	Dark yellowish brown (10YR 4/4) moist; sandy loam, pale brown (10YR 6/3) dry; weak medium subangular blocky; soft when dry, very friable when moist, nonsticky and nonplastic when wet; noncalcareous; pH 7.0; clear wavy boundary.
B21t	68-120	Yellowish brown (10YR 5/4) moist; sandy clay loam (20% clay est.); light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.3; gradual smooth boundary.
B22t	120-158	Yellowish brown (10YR 5/4) moist; sandy loam (18% clay est.); light yellowish brown (10YR 6/4) dry; weak coarse subangular blocky to weak medium subangular blocky; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; noncalcareous; pH 6.4; gradual wavy boundary.
B3	158-190	Light olive brown (2.5Y 5/4) moist; sandy loam; light yellowish brown (2.5Y 6/4); weak coarse subangular blocky; soft when dry, very friable when moist, nonsticky and nonplastic when wet; noncalcareous; pH 7.0; clear wavy boundary.
CR	190-219	Soft noncalcareous sandstone; pH 7.7.

Appendix Table A-1. (Continued)

SITE #12

Location: Northeast quarter of Northeast quarter of Sec. 33, T7N, R94W, Moffat County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A2	0-13	Brown (10YR 5/3) moist; sandy loam; brown (10YR 5/3) dry; weak thick platy to weak very fine granular; soft when dry, very friable when moist; nonsticky and nonplastic when wet; slightly calcareous; pH 7.4; abrupt smooth boundary.
B2t	13-28	Dark yellowish brown (10YR 4/4) moist; sandy clay loam (31% clay est.); pale brown (10YR 6/3) dry; moderate medium-coarse prismatic to strong coarse angular blocky; very hard when dry, firm when moist, sticky and plastic when wet; slightly calcareous; pH 9.2; clear smooth boundary.
B3ca	28-46	Yellowish brown (10YR 5/4) moist; sandy loam (24% clay est.); very pale brown (10YR 7/3); weak coarse subangular blocky to weak medium subangular blocky; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; slightly calcareous; pH 9.9; clear wavy boundary.
C1	46-64	Light yellowish brown (10YR 6/4) moist; loamy sand; very pale brown (10YR 7/4) dry; structureless massive; slightly hard when dry; very friable when moist, nonsticky and slightly plastic when wet; strongly calcareous; pH 10.0; clear wavy boundary.
IIC2	64-152	Light yellowish brown (10YR 6/4) moist; loamy sand; very pale brown (2.4Y 7/3) dry; strongly calcareous; pH 10.0.

Appendix Table A-1. (Continued)

SITE #13

Location: Northeast quarter of Southeast quarter of Sec. 15, T4N, R29W, Moffat County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-12	Brown to dark brown (10YR 4/3) moist; loam; pale brown (10YR 6/3) dry; moderate fine granular; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet, noncalcareous; pH 7.7; clear smooth boundary.
B21t	12-25	Dark grayish brown (10YR 4/2) moist; clay (39% clay est.); brown (10YR 5/3) dry; moderate medium subangular blocky; very hard when dry, very friable when moist, very sticky and very plastic when wet; noncalcareous; pH 7.7; clear smooth boundary.
B22t	25-40	Grayish brown (2.5Y 5/2) moist; clay loam (40% clay est.); light brownish gray (2.5Y 6/2) dry; moderate medium subangular blocky; very hard when dry, very firm when moist; very sticky and very plastic when wet; strongly calcareous; pH 8.2; clear smooth boundary.
B3ca	40-71	Grayish brown (2.5Y 5/2) moist; clay loam (32% clay est.); light gray (2.5Y 7/2) dry; weak medium subangular blocky; hard when dry, firm when moist, sticky and plastic when wet; strongly calcareous; pH 8.4; clear wavy boundary.
Cca	71-112	Grayish brown (2.5Y 5/2) moist; loam (32% clay est.); light brownish gray (2.5Y 6/2) dry; weak coarse subangular blocky; hard when dry, firm when moist, sticky and plastic when wet; strongly calcareous; pH 8.7; clear wavy boundary.
C	112-165	Grayish brown (2.5Y 5/2) moist; loam (26% clay est.); light brownish gray (2.5Y 6/2) dry; structureless; hard when dry, friable when moist, slightly sticky and plastic when wet; strongly calcareous; pH 8.6.

Appendix Table A-1. (Continued)

SITE #14

Location: Southeast quarter of Southeast quarter of Sec. 25, T4N, R96W, Garfield County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-13	Dark brown (10YR 3/3) moist; silt loam; dark grayish brown (10YR 4/2) dry; weak fine subangular blocky to moderate medium granylar; slightly hard when dry, very friable when moist, sticky and plastic when wet; noncalcareous; pH 6.6; clear smooth boundary.
B2	13-31	Very dark brown (10YR 2/2) moist; silt loam; dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky; slightly hard when dry, friable when moist, sticky and plastic when wet; noncalcareous; pH 6.7; clear smooth boundary.
B31	31-45	Brown to dark brown (10YR 4/3) moist; silt loam; brown (10YR 5/3) dry; weak medium subangular blocky; slightly hard when dry, very friable when moist, sticky and plastic when wet; noncalcareous; pH 6.7; clear wavy boundary.
B32	45-74	Yellowish brown (10YR 5/4) moist; silty clay loam (80% channery); very pale brown (10YR 7/4) dry; weak coarse subangular blocky; hard when dry, friable when moist; sticky and plastic when wet; slightly calcareous; pH 7.8; clear wavy boundary.
R	74-100	Hard bedrock; slightly calcareous; pH 7.2.

Appendix Table A-1. (Continued)

SITE #15

Location: Northeast quarter of Southwest quarter of Sec. 35, T4S, R96W, Garfield County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A11	0-36	Very dark brown (10YR 2/2) moist; loam (27% clay est.); dark grayish brown (10YR 4/2) dry; weak medium platy to moderate fine granular; soft when dry, very friable when moist, sticky and plastic when wet; noncalcareous; pH 6.6; clear smooth boundary.
A12	36-104	Black (10YR 2/1) moist; loam; dark gray (10YR 4/1) dry; weak coarse subangular blocky to moderate fine granular; slightly hard when dry, very friable when moist, sticky and plastic when wet; noncalcareous; pH 7.0; gradual smooth boundary.
C	104-162	Very dark brown (10YR 2/2) moist; loam; dark grayish brown (10YR 4/2) dry; coarse subangular blocky to moderate medium granular; slightly hard when wet, very griable when moist; slightly sticky and slightly plastic when wet; noncalcareous; pH 7.3; clear smooth boundary.
A1b	162-184	Very dark brown (10YR 2/2) moist; loam; dark grayish brown (10YR 4/2) dry; weak coarse subangular blocky to weak fine granular; slightly hard when dry; very friable when moist, sticky and plastic when wet; noncalcareous; pH 7.5.

Appendix Table A-1. (Continued)

SITE #16

Location: Northwest quarter of Northwest quarter of Sec. 18, T5S, R96W, Garfield County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A11	0-20	Dark brown (7.5YR 3/2) moist; loam; dark yellowish brown (10YR 4/4) dry; weak medium crumb to weak-moderate fine granular; soft when hard, very friable when moist, slightly sticky to slightly plastic when wet; noncalcareous; pH 6.5; clear wavy boundary.
A12	20-38	Brown to dark brown (7.5YR 4/2) moist; loam; brown (7.5YR 5/2) dry; moderate medium subangular blocky to moderate fine subangular blocky; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.6; clear wavy boundary.
A13	38-71	Brown to dark brown (7.5YR 4/2) moist; sandy loam; brown (7.5YR 5/2) dry; moderate medium subangular blocky to weak fine subangular blocky; slightly hard when dry, friable when moist, slightly plastic when wet; noncalcareous; pH 6.8; clear wavy boundary.
C1	71-132	Brown to dark brown (7.5YR 4/2) moist; sandy loam (40% channery); brown (7.5YR 5/4) dry; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic; noncalcareous; pH 7.3; clear wavy boundary.
R	132+	Fractured sandstone.

Appendix Table A-1. (Continued)

SITE #17

Location: Northeast quarter of Southwest quarter of Sec. 13, T5S, R96W, Garfield County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-15	Dark brown (10YR 3/3) moist; sandy clay loam (23% clay est.), 50% 3/4"-3" channery discarded; grayish brown (10YR 5/2) dry; weak medium subangular blocky to moderate fine granular; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.9; clear wavy boundary.
B2	15-44	Brown to dark brown (7.5YR 4/4) moist; loam, 40% 3"-10" channery discarded, 34% 3/4"-3" channery discharged brown (7.5YR 5/4) dry; weak medium subangular blocky; slightly hard when dry, friable when moist; sticky and plastic when wet; noncalcareous; pH 7.6; clear wavy boundary.
R	44+	Hard sandstone.

Appendix Table A-1. (Continued)

SITE #18

Location: Southeast quarter of Southwest quarter of Sec. 12, T5S, R96W, Garfield County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A11	0-15	Very dark grayish brown (10YR 3/2) moist; clay loam; brown to dark brown (10YR 4/3) dry; moderate fine granular; soft when dry, very friable when moist, sticky and plastic when wet; noncalcareous; pH 6.5; clear smooth boundary.
A12	15-64	Very dark brown (10YR 2/2) moist; clay loam; dark grayish brown (10YR 4/2) dry; moderate fine granular; slightly hard when dry, very friable when moist, sticky and plastic when wet; noncalcareous; pH 6.3; clear wavy boundary.
B2t	64-126	Brown to dark brown (7.5YR 4/4) moist; (7.5YR 6/6) dry; clay loam (34% clay est.); 24% channery 3/4" to 3" discarded; 21% channery 3" to 10" discarded; moderate fine to medium subangular blocky; hard when dry, friable when moist, sticky and plastic when wet; noncalcareous; pH 6.7; clear wavy boundary.
R	126+	Brown (7.5YR 5/4) moist; gravelly clay loam; light brown (7.5YR 6/4) dry; massive; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous.

Appendix Table A-1. (Continued)

SITE #19

Location: 1000 feet North of Southeast corner of Sec. 18, T3S, R96W, Rio Blanco County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-13	Dark yellowish brown (10YR 4/4) moist; loam (24% clay est.); light yellowish brown (10YR 6/4) dry; weak fine subangular blocky to weak fine granular; slightly hard when dry, very friable when moist, sticky and plastic when wet; slightly calcareous; pH 7.2; clear smooth boundary.
B2t	13-28	Dark yellowish brown (10YR 4/4) moist; clay loam (37% clay est.); pale brown (10YR 6/3) dry; moderate medium subangular blocky to weak medium subangular blocky; slightly hard when dry, friable when moist, sticky and plastic when wet, strongly calcareous; pH 7.9; clear smooth boundary.
B3ca	28-61	Yellowish brown (10YR 5/4) moist; silt loam (24% clay est.); pale brown (10YR 6/3) dry; weak coarse subangular blocky to moderate fine subangular blocky; slightly hard when dry, friable when moist, sticky and plastic when wet; violently calcareous; pH 8.0; gradual smooth boundary.
Cca	61-99	Yellowish brown (10YR 5/4) moist; loam very pale brown (10YR 7/3) dry; weak coarse subangular blocky to weak medium subangular blocky; slightly hard when dry, friable when moist, sticky and plastic when wet; violently calcareous; pH 8.4; gradual smooth boundary.
B21tcab	99-144	Brown to dark brown (7.5YR 4/4) moist; silt loam (28% clay est.); pink (7.5YR 7/4) dry; weak coarse to medium subangular blocky; hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; pH 8.6; clear smooth boundary.
B22tcab	144-190	Brown to dark brown (7.5YR 4/4) moist; loam loam (24% clay est.); pink (7.5YR 7/4) dry; moderate medium subangular blocky; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; pH 8.5; clear smooth boundary.
B23tcab	190-206	Brown to dark brown (7.5YR 4/4) moist; clay loam (25% clay est.); pink (7.5YR 7/4) dry; weak medium subangular blocky; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; pH 8.4, clear smooth boundary.

Appendix Table A-1. (Continued)

SITE #19 (continued)

Ccsb	206-245	Brown to dark brown (7.5YR 4/4) moist; loam (23% clay est.); light brown (7.5YR 6/4) dry; weak coarse subangular blocky; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; pH 8.2.
R	245+	Bedrock-gypsum concentration.

Appendix Table A-1. (Continued)

SITE #20

Location: Southeast quarter of Southeast quarter of Sec. 13, T3S, R97W, Rio Blanco County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-10	Brown to dark brown (7.4YR 4/4) moist; loam (16% clay est.); brown to dark brown (10YR 4/3) dry; weak moderate platy to weak fine granular; soft when dry, very friable when moist, nonsticky and nonplastic when wet; noncalcareous; pH 7.6; clear smooth boundary.
AC	10-27	Brown to dark brown (7.5YR 4/2) moist; loam; brown (7.5YR 5/2) dry; weak moderate subangular blocky to weak fine granular; soft when dry, friable when moist, nonsticky and nonplastic when wet; strongly calcareous; pH 8.0; clear wavy boundary.
Cr	27-40	Light yellowish brown (10YR 6/4) moist; (10YR 7/3) dry; loam; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; violently calcareous; pH 8.2; clear wavy boundary.
R	40+	Sandstone- 40% weathered channery at Cr - R boundary; pH 8.2.

Appendix Table A-1. (Continued)

SITE #21

Location: 1.5 miles up Ryan Gulch, 200 ft. North of road. Southeast quarter of Southeast quarter of Sec. 31, T1S, R98W, Rio Blanco County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-15	Brown to dark brown (10YR 4/3) moist; sandy loam (18% fine channery); pale brown (10YR 6/3) dry; weak fine granular; soft when dry, very friable when moist, nonsticky and nonplastic when wet; strongly calcareous; pH 8.2; clear wavy boundary.
C1	15-41	Dark yellowish brown (10YR 4/4) moist; sandy loam (17% fine channery); light yellowish brown (10YR 6/4) dry; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; violently calcareous; pH 8.3; clear wavy boundary.
C2	41-54	Dark yellowish brown (10YR 4/4) moist; sandy loam (50% fine to coarse channery with 5% cobble); light yellowish brown (10YR 6/4) dry; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; violently calcareous; pH 8.3; clear wavy boundary.
C3	54-94	Dark yellowish brown (10YR 4/4) moist; loamy sand/ sandy loam (33% channery ½" by ¼"); light yellowish brown (10YR 6/4) dry; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; strongly calcareous; pH 8.6; abrupt wavy boundary.
A1b	94-107	Brown to dark brown (10YR 4/3) moist; sandy loam (20% fine channery); pale brown (10YR 6/3) dry; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; violently calcareous; pH 8.5; clear wavy boundary.
IIC1	107-127	Dark yellowish brown (10YR 4/4) moist; sandy loam (33% fine channery); light yellowish brown (10YR 6/4) dry; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; violently calcareous; pH 8.2; clear wavy boundary.

Appendix Table A-1. (Continued)

SITE #21 (continued)

IIC2	127-153	Dark yellowish brown (10YR 4/4) moist; loamy sand (40% fine channery); light yellowish brown (10YR 6/4) dry; massive; slightly hard when dry, very friable when moist; nonsticky and nonplastic when wet; violently calcareous; pH 8.6; clear wavy boundary.
IIIC1	153-180	Dark yellowish brown (10YR 4/4) moist; loamy sand (nonchannery); light yellowish brown (10YR 6/4) dry; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; violently calcareous; pH 8.4; clear wavy boundary. Lime coating on underside of channery and in horizons below 54 cm. in depth.

Appendix Table A-1. (Continued)

SITE #22

Location: Northeast quarter of Northeast quarter of Sec. 12, T2S, R98W, (100 yds. South of road 50 ft. East of fenceline), Rio Blanco County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-30	Brown (10YR 5/3) moist; silt loam, pale brown (10YR 6/3) dry; moderate coarse platy to weak fine granular; soft when dry, very friable when dry, very friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.4.
A1b	30-46	Brown to dark brown (10YR 4/3) moist; silt loam; pale brown (10YR 6/3) dry; moderate medium subangular blocky to moderate fine subangular blocky; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.1.
IIC1	46-99	Yellowish brown (10YR 5/4) moist; silt loam; light yellowish brown (10YR 6/4) dry; weak coarse subangular blocky; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; strongly calcareous; pH 8.5.
IIIA1b	99-110	Dark brown (7.5YR 3/2) moist; loam; brown (7.5YR 5/2) dry; weak medium subangular blocky to weak fine granular; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.6.
IIIC1	110-143	Brown to dark brown (7.5YR 4/4) moist; sandy loam; light yellowish brown (10YR 6/4) dry; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; violently calcareous; pH 8.5.
IIIC2	143-160	Brown to dark brown (7.5YR 4/4) moist; sandy loam; light yellowish brown (10YR 6/4) dry; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; violently calcareous; pH 8.0.
IVA1b	160-180	Brown to dark brown (10YR 4/3) moist; silt loam (16% clay est.); pale brown (10YR 6/3) dry; moderate medium to coarse subangular blocky; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; strongly calcareous; pH 7.9.
IVC1	180-198	Brown (10YR 5/3) moist; silt loam (16% clay est.), pale brown (10YR 6/3) dry; weak coarse subangular blocky; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; violently calcareous; pH 8.0.

Appendix Table A-1. (Continued)

SITE #23

Location: Northwest quarter of Southwest quarter of Sec. 19, T1S, R97W, Rio Blanco County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A2	0-8	Brown (10YR 5/3) moist; loam; light gray (10YR 7/2) dry; weak coarse platy to weak fine granular; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; noncalcareous; pH 7.6; abrupt smooth boundary.
B2t	8-21	Brown to dark brown (7.5YR 4/4) moist; silty clay (37% clay est.); brown (7.5YR 5/4) dry; moderate medium columnar to moderate-strong fine angular blocky; hard when dry, firm when moist, very sticky and very plastic when wet; slightly calcareous; pH 7.8; clear smooth boundary.
B3ca	21-41	Brown (7.5YR 5/4) moist; silty clay loam (32% clay est.); brown (10YR 5/3) dry; moderate fine-medium subangular blocky; hard when dry, firm when moist, sticky and plastic when wet; strongly calcareous; pH 8.2; clear smooth boundary.
C1ca	41-82	Pale brown (10YR 6/3) moist; loam; very pale brown (10YR 8/3) dry; moderate medium-coarse subangular blocky; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; violently calcareous; pH 8.4; gradual smooth boundary.
C2	82-152	Yellowish brown (10YR 5/4) moist; loam; brownish yellow (10YR 6/6) dry; moderate medium-coarse subangular blocky to moderate fine subangular blocky; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.4; clear wavy boundary.
IIC1ca	152-200	Dark yellowish brown (10YR 4/4) moist; loam; light yellowish brown (10YR 6/4) dry; moderate fine to coarse subangular blocky; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; violently calcareous; pH 8.4.

Appendix Table A-1. (Continued)

SITE #24

Location: Northwest quarter of Southwest quarter of Sec. 19, T1S, R97W, Rio Blanco County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-10	Dark brown to brown (10YR 4/3) moist; loam; brown (10YR 5/3) dry; weak medium granular; very friable when moist, soft when dry, nonsticky and nonplastic when wet; noncalcareous; pH 7.8, clear smooth boundary.
B2	10-26	Dark brown to brown (7.5YR 4/4) moist; clay loam (32% clay est.); yellowish brown (10YR 5/4) dry; weak medium subangular blocky; friable when moist, slightly hard when dry, sticky and plastic when wet, slightly calcareous, pH 7.6, clear smooth boundary.
B3ca	26-39	Yellowish brown (10YR 5/4) moist; silty clay loam; light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky to moderate fine subangular blocky; friable when moist, slightly hard when dry, sticky and plastic when wet; strongly calcareous; pH 8.0, clear smooth boundary.
Cca	39-92	Pale brown (10YR 6/3) moist; loam; very pale brown (10YR 7/3) dry; moderate to medium-coarse subangular blocky; friable when moist, slightly hard when dry, slightly sticky and slightly plastic when wet, strongly calcareous, pH 8.6, clear wavy boundary.
C	92-143	Yellowish brown (10YR 5/4) moist; loam; brownish yellow (10YR 6/6) dry; moderate medium-coarse angular blocky to moderate fine subangular blocky; very friable when moist, slightly hard when dry, slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.6; gradual wavy boundary.
IICca	143-200	Dark yellowish brown (10YR 4/4) moist; loam; light yellowish brown (10YR 6/4) dry; moderate coarse subangular blocky to moderate fine subangular blocky; friable when moist, slightly hard when dry, slightly sticky and slightly plastic when wet, strongly calcareous, pH 8.4.

Appendix Table A-1. (Continued)

SITE #21

Location: Northeast quarter of Southwest quarter of Sec. 25, T1S, R98W, Rio Blanco County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
Ap	0-13	Brown to dark brown (10YR 4/3) moist; silty cla light gray (10YR 7/2) dry; weak coarse platy to moderate fin granular; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; stron 7.9; clear boundary.
A11	13-37	Dark grayish brown (10YR 4/2) silty clay light gray (10YR 7/2) dry; mode medium subangular blocky to moderate very fi subangular blocky; slightly hard when dry, when moist, sticky and plastic wet; strongly calcareous; pH 8.1, clear boundary.
A12	37-69	Dark grayish brown (10YR 4/2) moist; silty clay loam; light brownish gray (10YR 6/2) dry; weak medium subangular blocky to moderate fine granular, slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.1; clear wavy boundary.
C1	69-80	Brown (10YR 5/3) moist; sandy loam; pale brown (10YR 6/3) dry; massive, slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous, pH 8.0; clear wavy boundary.
C2	80-104	Grayish brown (2.5Y 5/2) gray silty cla loam (30% clay est.); light brownish gray (2.5Y 6/2) dry; weak medium subangular blocky; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; pH 8.0; clear wavy boundary.
A1b	104-122	Very dark grayish brown (10YR 3/2) with very dark brown streaks (10YR 2/2) moist; silty clay loam with 10% mottles of yellowish brown (10YR 5/8); light brownish gray (10YR 6/2) dry; weak coarse subangular blocky; slightly hard when dry, sticky and plastic when moist, slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.2 clear wavy boundary.

Appendix Table A-1. (Continued)

SITE #25 (Continued)

IIC1g	122-158	Grayish brown (10YR 5/2) moist; sandy loam with 30% mottles of yellowish brown (10YR 5/8) and brownish yellow (10YR 6/8); light gray (10YR 7/2) dry; massive; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; pH 8.4; clear wavy boundary.
IIC2g	158-204	Yellowigh brown (10YR 5/6) moist; loam with 20% yellowish brown (10YR 5/8) and brownish yellow (10YR 6/8) mottling; very pale brown (10YR 7/4) dry; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; strongly calcareous; pH 8.3.

Appendix Table A-1. (Continued)

SITE #26

Location: Northeast quarter of Northeast quarter of Sec. 10, T2S, R99W, Rio Blanco County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-13	Dark brown (10YR 3/3) moist; sandy loam (channery); pale brown (10YR 6/3) dry; weak very fine granular; soft when dry, very friable when moist, nonsticky and nonplastic when wet; slightly calcareous; pH 8.1 clear smooth boundary.
C1	13-23	Brown to dark brown (10YR 4/3) moist; sandy loam (very channery); very pale brown (10YR 7/3) dry; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; strongly calcareous; pH 8.2; gradual smooth boundary.
Cr	23-41	Light yellowish brown (10YR 6/4) moist; loam (80% channery of 2 in. to 10 in. in length and from 1 in. to 2 in. in diameter); very pale brown (10YR 8/4) dry; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; strongly calcareous; pH 8.3; clear smooth boundary.
R	41+	Sandstone; pH 8.8.

Appendix Table A-1. (Continued)

SITE #27

Location: Northeast quarter of Northwest quarter of Sec. 10, T2S, R99W, Rio Blanco County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-11	Brown to dark brown (10YR 4/3) moist; loam; brown (10YR 5/3) dry; weak fine granular; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; noncalcareous to slightly calcareous; pH 7.6; clear smooth boundary.
B2	11-30	Brown to dark brown (10YR 4/3) moist; loam; brown (10YR 5/3) dry; weak medium subangular blocky; slightly hard when dry, friable when moist, sticky and plastic when wet; slightly calcareous; pH 8.0; gradual smooth boundary.
C1	30-56	Brown to dark brown (10YR 4/3) moist; loam; pale brown (10YR 6/3) dry; weak medium subangular blocky; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.0; clear wavy boundary.
R	56+	Sandstone.
		Few, fine channery on surface and throughout profile.

Appendix Table A-1. (Continued)

SITE #28

Location: Southeast quarter of Southeast quarter of Sec. 31, T4N, R86W, Routt County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-8	Very dark grayish brown (10YR 3/2) moist, silty clay loam (33% clay est.); light brownish gray (10YR 6/2) dry; weak thick platy to moderate fine subangular blocky; friable when moist; slightly hard when dry, sticky and plastic when dry; sticky and plastic when wet; strongly calcareous; pH 6.5; abrupt smooth boundary.
B21	8-15	Dark grayish brown (2.5Y 4/2) moist; clay (45% clay est.); dark grayish brown (2.5Y 4/2) dry; strong medium angular blocky; firm when moist, very hard when dry; very sticky and very plastic when wet; strongly calcareous, pH 7.0; clear smooth boundary.
B22	15-46	Dark brown (10YR 3/3) moist; clay (45% clay est.); brown (10YR 5/3) dry; strong coarse prismatic to strong medium angular blocky; firm when moist, very hard when dry, very sticky and very plastic when wet; strongly calcareous, pH 8.0; clear wavy boundary.
B3	46-71	Dark brown (10YR 4/3) moist; clay (45% clay est.); pale brown (10YR 6/3) dry; moderate medium subangular blocky; firm when moist, very hard when dry, very sticky and very plastic when wet; strongly calcareous; pH 8.2; clear smooth boundary.
C	71-81	Brown (10YR 5/3) moist; silty clay, pale brown (10YR 6/3) dry; weak medium subangular blocky, firm when moist; hard when dry; very sticky and very plastic when wet; violently calcareous; pH 8.3; abrupt smooth boundary.
Cr	81+	Platy soft weathered shale; pH 8.5.

Appendix Table A-1. (Continued)

SOIL #29

Location: Northeast quarter of Southwest quarter of Sec. 8, T4N, R86W, Routt County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A11	0-36	Very dark brown (10YR 2/2) moist; sandy clay loam (24% clay est.) very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky; soft when dry, very friable when moist, nonsticky and nonplastic when wet; noncalcareous; pH 6.5; smooth boundary.
A12	36-66	Very dark brown (10YR 2/2) moist; loam (26% clay est.); dark grayish brown (10YR 4/2) dry; weak coarse subangular blocky; soft when dry, very friable when moist, nonsticky and nonplastic when wet; noncalcareous; pH 6.7; clear wavy boundary.
A2b	66-77	Yellowish brown (10YR 5/4) moist; loam (26% clay est.); pale brown (10YR 6/3) dry; moderate medium to fine subangular blocky; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.7 abrupt smooth boundary.
B&AB	77-118	Yellowish brown (10YR 5/4) moist; clay loam (32% clay est.); light yellow brown (10YR 6/4) dry; strong fine angular blocky; slightly hard when dry, friable when moist, sticky and plastic when wet; noncalcareous; pH 6.7; clear smooth boundary.
B21tb	118-178	Dark yellowish brown (10YR 4/4) moist; clay loam (34% clay est.); light yellowish brown (10YR 6/4) dry; strong medium angular blocky; hard when dry, firm when moist, sticky and plastic when wet; noncalcareous; pH 6.8; clear smooth boundary.
B22tb	178-234	Yellowish brown (10YR 5/4) moist; clay loam (34% clay est.); light yellowish brown (10YR 6/4) dry; strong coarse prismatic; very hard when dry, firm when moist, sticky and plastic when wet; slightly calcareous; pH 8.2; clear wavy boundary.
C	234-254	Yellowish brown (10YR 5/4) moist; loam (no clay est.), light yellowish brown (10YR 6/4) dry; strong coarse subangular blocky; very hard when dry, firm when moist, slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.0.

Appendix Table A-1. (Continued)

SITE #30

Location: Southeast quarter of Northwest quarter of Sec. 17, T4N, R86W, Routt County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
01	4-2	Undecomposed leaves and twigs.
02	2-0	Decomposed organic material.
A11	0-13	Very dark grayish brown (10YR 3/2) moist; silty loam; very dark grayish brown (10YR 3/2) dry; moderate fine subangular blocky; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.3; gradual smooth boundary.
A12	13-47	Very dark grayish brown (10YR 3/2) moist; silty loam; very dark grayish brown (10YR 3/2) dry; moderate fine subangular blocky to moderate fine granular; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.5; gradual smooth slope.
A13	47-89	Very dark grayish brown (10YR 3/2) moist; silty loam; dark grayish brown (10YR 4/2) dry; weak coarse subangular blocky to weak fine granular; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.6; gradual smooth boundary.
B	89-127	Very dark brown (10YR 2/2) moist; silty loam; dark brown (10YR 3/3) dry; weak coarse subangular blocky; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.6.
Cr	127+	Yellowish brown (10YR 5/6) moist; soft weathered sandstone.

Appendix Table A-1. (Continued)

SITE #31

Location: Southeast quarter of Southwest quarter of Sec. 30, T6N, R88W, Routt County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-8	Dark brown (10YR 3/3) moist; silty clay (37% est.); pale brown (10YR 6/3) dry; moderate medium subangular blocky to moderate fine granular; hard when dry, firm when moist, very sticky and very plastic when wet; strongly calcareous; pH 7.8; clear smooth boundary.
B21	8-26	Brown to dark brown (10YR 4/3) moist; clay (42% clay est.); grayish brown (10YR 5/2) dry; strong fine to very fine angular blocky; very hard when dry, firm when moist, very sticky and very plastic when wet; strongly calcareous; pH 7.9; clear smooth boundary.
B22	26-89	Yellowish brown (10YR 5/4) moist; clay (50% clay est.); light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky; very hard when dry, firm when moist, very sticky and very plastic when wet; strongly calcareous; pH 8.4; gradual smooth boundary.
B3cacs	89-122	Brown to dark brown (10YR 4/3) moist; silt (37% clay est.); light brownish gray (10YR 6/2) dry; moderate medium subangular blocky; hard when dry, friable when moist; very sticky and very plastic when wet; violently calcareous; pH 8.1; clear wavy boundary.
Cr	122-148	Weathered conglomerate of sandstone and shale.

Appendix Table A-1. (Continued)

SITE #32

Location: Northwest quarter of Southwest quarter of Sec. 29, T6N, R88W, Routt County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A2	0-5	Brown to dark brown (10YR 4/3) moist; silt loam (17% clay est.); light gray (10YR 7/2) dry; moderate medium platy to weak fine granular; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; noncalcareous; pH 6.8; abrupt smooth boundary.
B21t	5-23	Brown to dark brown (10YR 4/3) moist; silty clay loam (40% clay est.); brown (10YR 5/3) dry; moderate medium subangular blocky; very hard when dry, firm when moist, very sticky and very plastic when wet; strongly calcareous; pH 7.0; clear wavy boundary.
B22tsa	23-64	Brown to dark brown (10YR 4/3) moist; silty clay (40% clay est.); brown (10YR 5/3) dry; moderate medium subangular blocky very hard when dry, firm when moist, very sticky and very plastic when wet; strongly calcareous; pH 8.2; clear smooth boundary.
B3sa	64-104	Brown to dark brown (10YR 4/3) moist; silty clay (45% clay est.); pale brown (10YR 6/3) dry; weak moderate subangular blocky; very hard when dry, firm when moist, very sticky and very plastic when wet; strongly calcareous; pH 8.4; clear smooth boundary.
Csacs	104-155	Brown to dark brown (10YR 4/3) moist; silty clay (45% clay est.); brown (10YR 5/3) dry; moderate coarse subangular blocky; very hard when dry, firm when moist, very sticky and very plastic when wet; strongly calcareous; pH 8.5.

Appendix Table A-1. (Continued)

SITE #33

Location: Southwest quarter of Northwest quarter of Sec. 33, T13, R97W. Rio Blanco County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-13	Dark grayish brown (10YR 4/2) moist; silty clay loam; light brownish gray (2.3Y 5/2) dry; weak fine granular to moderate medium granular; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.2; abrupt wavy boundary.
C1	13-23	Yellowish brown (10YR 5/4) moist; sandy loam, light brownish gray (2.5Y 6/2) dry; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; strongly calcareous; pH 8.9; abrupt wavy boundary.
A1bg	23-69	Stratified dark grayish brown (10YR 4/2) and brown to dark brown (10YR 4/3) with brown (10YR 4/4) and gray (2.5Y 5/2); mottling; silty clay loam; light brownish, moderate medium subangular blocky to moderate medium granular; hard when dry, friable when moist, sticky and plastic when wet, strongly calcareous; pH 8.7, abrupt wavy boundary.
C2b1g	69-94	Yellowish brown (10YR 5/4) moist with few, fine, distinct brown to dark brown (7.5YR 4/4) mottles and few, fine, faint dark grayish brown (2.5Y 4/2) mottles; silty clay loam; light brownish gray (2.5Y 6/2) dry; massive; slightly hard when dry; friable when moist; slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.7, clear wavy boundary.
C3b2g	94-119	70% grayish brown (2.5Y 5/2) moist with 30% gray (N/5) gleying; loam; light gray (5Y 7/1) dry, massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; pH 8.8.

Appendix Table A-1. (Continued)

SITE #34

Location: 980 feet North, 100 feet West of Southwest corner of Sec. 4, T3N, R93W, Moffat County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-5	Dark brown (7.5YR 3/2) moist; sandy loam (17% clay est.); brown (7.5YR 5/2) dry; weak fine granular; soft when dry, very friable when moist, nonsticky and nonplastic when wet; noncalcareous; pH 6.9.
A2	5-10	Brown to dark brown (7.5YR 4/2) moist; loam (17% clay est.); pinkish gray (7.5YR 6/2) dry; moderate pink platy to weak fine granular; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.9.
B&A	10-23	Brown to dark brown (7.5YR 4/2) moist; clay loam (36% clay est.); pinkish gray (7.5YR 6/2) dry; weak medium subangular blocky, to strong fine subangular blocky; hard when dry, friable when moist, sticky and plastic when wet; noncalcareous; pH 6.6.
B21t	23-39	Brown to dark brown (7.5YR 4/2) moist; clay (40% clay est.); brown (7.5YR 5/2); moderate medium columnar to strong coarse subangular blocky; extremely hard when dry, very firm when moist, very sticky and very plastic when wet; noncalcareous; pH 6.9.
B22t	39-56	Brown to dark brown (7.5YR 4/2) moist; clay (38% clay est.); gray to light gray (10YR 6/1); moderate medium columnar to strong coarse subangular blocky; extremely hard when dry, very firm when moist, very sticky and very plastic when wet; noncalcareous; pH 8.1.
B3tca	56-79	Dark grayish brown (2.5Y 4/2) moist; silty clay (38% clay est.); light brownish gray (2.5Y 6/2) dry; weak coarse prismatic to weak coarse subangular blocky; very hard when dry, very firm when moist, very sticky and very plastic when wet; strongly calcareous; pH 8.5.

Appendix Table A-1. (Continued)

SITE #34 (Continued)

Cca	79-100	Dark gray (5Y 4/1) moist; silty clay (38% clay est.); light gray to gray (5Y 6/1) dry; weak coarse subangular blocky to weak medium subangular blocky; very hard when dry, firm when moist, very sticky and very plastic when wet; strongly calcareous; pH 8.3.
Ccs	100-153	Dark gray (5Y 4/1) moist; silty clay, olive gray (5Y 5/2) dry; weak coarse subangular blocky; very hard when dry, very firm when moist, sticky and plastic when wet, strongly calcareous; pH 8.3.
Cr	153-165	Very dark gray (5Y 3/1) moist; silty clay; gray (5Y 5/1) dry; noncalcareous; pH 8.3.

Appendix Table A-1. (Continued)

SITE #35

Location: 525 feet South, 400 feet East of center of Sec. 9, T3N, R93W, Moffat County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-7	Dark brown (7.5YR 3/2) moist; clay loam; brown (7.5YR 5/2) dry; moderate medium granular; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.3p clear smooth boundary.
B1	7-20	Dark brown (7.5YR 3/2) moist; clay loam; brown (7.5YR 5/2) dry; moderate medium subangular blocky to moderate fine subangular blocky; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.6, abrupt smooth boundary.
B21t	20-38	Dark brown (7.5YR 3/2) moist; silty clay (38% clay est.); brown (7.5YR 5/2) dry; strong medium subangular blocky to strong fine subangular blocky; very hard when dry, firm when moist, sticky and plastic when wet; noncalcareous; pH 6.3; clear smooth boundary.
B22t	38-68	Dark brown (7.5YR 3/2) moist; clay (40% clay est.); brown (7.5YR 5/2) dry; moderate medium subangular blocky; very hard when dry, very firm when moist, very sticky and very plastic when wet; noncalcareous; pH 6.5; clear wavy boundary.
B31ca	68-81	Brown to dark brown (7.5YR 4/4) moist; silty clay (37% clay est.); light brown (7.5YR 6/4) dry; moderate medium prismatic to moderate medium subangular blocky; very hard when dry, very firm when moist, sticky and plastic when wet; strongly calcareous; pH 7.5; gradual smooth boundary.
B32ca	81-107	Brown (7.5YR 5/4) moist; silty clay (32% clay est.); pinkish gray (7.5YR 7/2) dry; moderate medium subangular blocky; hard when dry, firm when moist, sticky and plastic when wet; strongly calcareous; pH 7.8; clear wavy boundary.

Appendix Table A-1. (Continue)

SITE #35 (Continued)

Cca	107-130	Pinkish gray (7.5YR 7/2) moist; clay; pinkish white (7.5YR 8/2) dry; weak coarse subangular blocky; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; strong calcareous; pH 8.2, abrupt wavy boundary.
R	130-163	Fractured sandstone; pH 7.9.

Appendix Table A-1. (Continued)

SITE #36

Location: 1400 feet North, 800 feet West of center of Sec. 16, T3N, R93W, Moffat County, Colorado.

Soil Profile:

Horizon	Depth (cm)	Description
A1	0-15	Very dark brown (10YR 2/2) moist; silty clay loam (24% clay est.); very dark gray (10YR 3/1) dry; weak medium subangular blocky to moderate fine granular; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; noncalcareous; pH 6.8; clear smooth boundary.
A3	15-31	Very dark brown (10YR 2/2) moist; silty clay loam (28% clay est.); very dark bray (10YR 3/1) dry; moderate fine subangular blocky to moderate fine granular; slightly hard when dry, very friable when moist; slightly sticky and slightly plastic when wet; noncalcareous; pH 6.7; clear smooth boundary.
B21t	31-66	Very dark grayish brown (10YR 3/2) moist; silty clay (37% clay est.); dark gray (10YR 4/1) dry; strong fine subangular blocky, very hard when dry, firm when moist, sticky and plastic when wet; noncalcareous; pH 6.8; gradual smooth boundary.
B22t	66-94	Very dark grayish brown (10YR 3/2) moist; clay loam (38% clay est.); brown (10YR 5/3) dry; moderate medium subangular blocky to moderate fine subangular blocky; very hard when dry, firm when moist, sticky and plastic when wet; noncalcareous; pH 6.9; clear smooth boundary.
IIC	94-112	Brown to dark brown (10YR 4/3) moist; loam (30% clay est.); yellowish brown (10YR 5/4) dry; moderate medium subangular blocky; hard when dry, friable when moist, sticky and plastic when wet; noncalcareous, pH 7.1; abrupt wavy boundary.
IIICca	112-150	Gray to light gray (10YR 6/1) moist; silty clay (32% clay est.); light gray (10YR 7/1) dry; moderate coarse prismatic to moderate coarse subangular blocky; hard when dry, firm when moist, sticky and plastic when wet; strongly calcareous; pH 8.0.

Appendix Table A-1. (Continued)

Site No.	Parent Material	Physiography	Relief	Elevation (feet)	Slope %	Aspect	Annual Precip. (in.)	Dominant Native Vegetation or Crop
1	sandstone and shale alluvium	mountain slope	steep	7,600	40	NE	18-20	Aspen
2	slope wash alluvium	mountain slope	sloping to steep	7,860	16	NE	18-20	Big sagebrush, mountain silver sagebrush, blue grasses
3	aeolian over Lewis shale	upland	undulating to rolling	6,520	3	NE	12-14	Big sagebrush, western wheat, low rabbit brush
4	loamy calcareous alluvium	fan	rolling	6,320	5	E	12-14	Big sagebrush, tall rabbitbrush, western wheat, bluebunch wheat
5	alluvium from shale	upland	rolling	6,360	6	SW	12-14	Big sagebrush, greasewood, shadscale, western wheat
6	shale residium	upland	rolling	6,560	10	S	12-14	Big sagebrush, western wheat grass, bluebunch wheat grass
7	sandstone and shale slope wash alluvium	mountain slope	steep	7,600	45	NE	20	Gambel oak, chokecherry, serviceberry

Appendix Table A-2. Site characteristics associated with soils studied.

Site No.	Parent Material	Physiography	Relief	Elevation (feet)	Slope %	Aspect	Annual Precip. (in.)	Dominant Native Vegetation or Crop
8	outwash and loess	bench upland	undula-lating	6,380	4	SW	12-13	(wheat stubble), big sagebrush, low rabbit-brush, winter fat, western wheat grass
9	shale and sandstone	mountain slope	sloping	7,200	9	W	18	Needle grass, mountain brome, slender wheat-grass
10	shale	mountain slope	steep	7,320	40	W	18	Needle grass, mountain brome, bluegrass, Nevada bluegrass
11	fine-grained sandstone	mountain slope	sharply sloping	6,800	20	NE	16	Elk sedge, bluegrass, prairie June grass
12	alluvium	terrace	gently sloping	6,000	6	N	15	Big sagebrush, grease-wood, squirreltail
13	alluvium from shale	hillside	sloping	6,330	2	E	13	Western wheatgrass, big sagebrush, paintbrush
14	horizontally bedded sandstone and shale	bench upland	undula-ting	8,370	5	NW	18	Big sagebrush, snow-berry, bitter brush, serviceberry

Appendix Table A-2. (Continued)

Site No.	Parent Material	Physiography	Relief	Elevation (feet)	Slope %	Aspect	Annual Precip. (in.)	Dominant Native Vegetation or Crop
15	alluvium	mountain swale or narrow valley bottom	gently sloping	7,840	3	E	16	Kentucky bluegrass, yarrow dandelion, prostrate knotweed
16	sandstone	mountain slope	sloping convex	8,100	10	NW	18+	Big sagebrush, snowberry, bitter brush, low rabbitbrush
17	sandstone	mountain slope	steep	8,100	35	SW	18+	Big sage, bitter brush, snowberry, gambel oak (scattered)
18	shale and sandstone	mountain slope	steep	7,750	35	NW	18+	Aspen, serviceberry, snowberry, chokecherry
19	loess over sandstone	upland slope and bench	undulating	6,690	3	NE	16	Western wheat grass, needle and thread grass
20	Uinta sandstone	upland ridges	rolling to moderately steep	6,900	6	NW	17	Pinyon, Juniper, serviceberry, mountain mahogany
21	alluvium from sandstone	outwash fan	gently sloping concave	6,170	5	S	16	Greasewood, big sagebrush, Green's rabbitbrush

Appendix Table A-2. (Continued)

Site No.	Parent Material	Physiography	Relief	Elevation (feet)	Slope %	Aspect	Annual Precip. (in.)	Dominant Native Vegetation or Crop
22	alluvium	narrow valley bottom	gently sloping	6,360	2	NE	16	Greasewood, big sagebrush, tall rabbitbrush
23	loess	rolling upland	undulating somewhat concave	6,690	3	NE	16	Greasewood, big sagebrush, shadscale, winterfat
24	loess	rolling upland	undulating	6,690	1	NE	16	Big sagebrush, winterfat, cactus, juniper (scattered)
25	mixed alluvium	valley bottom	nearly level	6,350	1	E-NE	14-16	(Smooth Brome pasture), Basin wild rye, Kentucky bluegrass, big sagebrush, tall rabbitbrush
26	sandstone	mountain slope and ridge top	sloping	7,070	6	S	16	Bluebunch, wheat grass, Elk sedge, needle and thread
27	loess and alluvium over sandstone	mountain slope	undulating	7,050	12	N-NE	16	Big sagebrush, low rabbitbrush, needle and thread

Appendix Table A-2. (Continued)

Site No.	Parent Material	Physiography	Relief	Elevation (feet)	Slope %	Aspect	Annual Precip. (in.)	Dominant Native Vegetation or Crop
28	Lewis shale	upland ridge top	rolling	7,040	5-7	NE	17	Chicken leaf, blue-grasses, bottlebrush, squirreltail, western wheat, onion, phlox
29	alluvium from sandstone	mountain slope	rolling	7,440	19	NE	18	Big sagebrush, snowberry, chokecherry, yarrow, Gambel oak, western wheat grass
30	aeolian and alluvium from sandstone	mountain slope	upland	7,600	14	NW	20	Aspen, snowberry, chokecherry, onion grass, Columbia needle grass, aspen peavine
31	Lewis shale	upland	rolling	6,480	5	NE	16	Alkaline sage, western wheat grass, crested wheat grass, fleabone, yarrow
32	alluvium from shale	bottom or low	gently sloping	6,300	2	E	16	Greasewood, alkaline sage, western wheat grass, onion, fleabone, bottlebrush, squirrel-tail

Appendix Table A-2. (Continued)

Site No.	Parent Material	Physiography	Relief	Elevation (feet)	Slope %	Aspect	Annual Precip. (in.)	Dominant Native Vegetation or Crop
33	alluvium from mixed calcareous sandstone and shale	floodplain	smooth	6,083	< 1	N	16	Sedges, rushes, narrow leaf sedge
34	Lewis shale	upland	concave	7,450	5	NW	18	Big sage, wild onion, western wheat grass, bluegrass, low rabbit brush
35	sandstone and shale	upland	concave	7,700	8	NW	18	Big sage, serviceberry, mountain brome, yarrow, bluegrass, snowberry
36	Lewis shale and sandstone	upland	convex	8,020	10	NW	18	Big sage, snowberry, slender wheat grass, yarrow, mountain big bluegrass

Appendix Table A-2. (Continued)

Site No.	Series*	Family	Subgroup	Order
1	--	clayey-skeletal, mixed	Boralfic Cryoborolls	Mollisols
2	--	fine-loamy, mixed	Pachic Cryoborolls	Mollisols
3	Forelle (est.)	fine-loamy, mixed	Borollic Haplargids	Aridisols
4	Lone pine (est.)	fine-silty, mixed	Borollic Camborthids	Aridisols
5	--	fine-loamy, mixed	Borollic Natrargids	Aridisols
6	--	fine-loamy, mixed	Borollic Camborthids	Aridisols
7	--	fine-loamy, mixed	Argic Ustic Cryoborolls	Mollisols
8	--	fine-loamy, mixed	Aridic Argiborolls	Mollisols
9	--	fine, montmorillonitic	Pachic Argiborolls	Mollisols
10	Work (est.)	fine, montmorillonitic	Typic Argiborolls	Mollisols
11	--	fine-loamy, mixed	Aridic Argiborolls	Mollisols
12	--	fine-loamy over sandy skeletal, mixed	Borollic Natrargids	Aridisols
13	--	fine, montmorillonitic	Borollic Haplargids	Aridisols
14	--	fine-loamy, mixed	Typic Cryoborolls	Mollisols
15	Silas (prop.)	fine-loamy, mixed	Cumulic Cryoborolls	Mollisols
16	--	coarse-loamy, mixed	Typic Cryoborolls	Mollisols
17	Irigul (est.)	loamy-skeletal, mixed	Lithic Cryoborolls	Mollisols

Appendix Table A-3. Taxonomic classification of soils studied. *-- = unnamed tent. = tentative est. = established prop. = proposed

Site No.	Series*	Family	Subgroup	Order
18	Northwater (tent.)	loamy-skeletal, mixed	Argic Pachic Cryoborolls	Mollisols
19	Forelle (est.)	fine-loamy, mixed	Borollic Haplargids	Aridisols
20	--	loamy, mixed, frigid	Lithic Ustic Torriorthents	Entisols
21	--	coarse loamy, mixed, frigid	Ustic Torrifluvents	Entisols
22	--	coarse-silty, mixed	Ustic Torrifluvents	Entisols
23	--	fine, montmorillonitic	Borollic Natrargids	Aridisols
24	--	fine-silty, mixed	Borollic Camborthids	Aridisols
25	Havre (est.)	fine-silty, mixed	Ustic Torrifluvents	Entisols
26	Renisac (est.)	loamy-skeletal, mixed	Lithic Ustic Torriorthents	Entisols
27	Chaperton (prop.)	fine-loamy, mixed	Borollic Camborthids	Aridisols
28	Abor (est.)	fine, montmorillonitic	Borollic Camborthids	Aridisols
29	--	fine-loamy, mixed	Cryic Pachic Paleborolls	Mollisols
30	Adel (est.)	fine-loamy, mixed	Pachic Cryoborolls	Mollisols
31	Bulkley (tent.)	fine, montmorillonitic	Borollic Vertic Camborthids	Aridisols
32	Absher (est.)	fine, montmorillonitic	Borollic Natrargids	Aridisols

Appendix Table A-3. (Continued)

*-- = unnamed tent. = tentative
est. = established prop. = proposed

Site No.	Series*	Family	Subgroup	Order
33	Hagga (tent.)	fine-loamy, mixed (calcareous), frigid	Typic Fluvaquents	Entisols
34	Campspass (tent.)	fine, montmorillonitic	Typic Eutroboralfs	Alfisols
35	Work (est.)	fine, montmorillonitic	Typic Argiborolls	Mollisols
36	Burnette (est.)	fine, montmorillonitic	Argic Pachic Cryoborolls	Mollisols

Appendix Table A-3. (Continued)

*-- = unnamed tent. = tentative
est.= established prop. = proposed

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
1	A11	0-18	2.1	1.4	.5	3.1	10.0	17.1	52.4	30.6	sicl	10.6	6.6	6.6	65.9	37.0	21.3
2	A12	18-64	.6	.6	.5	2.6	10.2	14.5	54.0	31.4	sicl	10.8	6.6	6.6	57.5	33.2	18.7
3	A2	64-71	1.3	1.2	.5	2.1	12.5	17.6	60.6	21.8	sil	14.0	--	31.0	34.4	21.3	11.8
4	B&A	71-99	.7	.5	.3	1.6	6.7	9.8	52.0	38.2	sicl	29.3	--	64.0	38.2	22.2	15.5
5	B2t	99-130	.3	.1	.1	.5	2.8	3.8	46.6	49.6	sic	19.9	--	64.0	53.6	23.8	17.0
6	C	130-180	0	0	.1	.8	3.7	4.6	45.5	49.9	sic	34.4	--	64.0	57.8	24.9	17.5

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

** Converted from percentage by volume as estimated in the field, using Guide Sheet No. 1 In Guide For Interpreting Engineering Uses of Soils. Also bulk density of soil equal to 1.5 gm/cc.

Site No. 1

Appendix Table A-4. Particle size and moisture content analysis of all horizons of soils studied.

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)									Coarse Fragments			Moisture Content %		
			Sand*					Total			Texture						
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
7	A11	0-25	1.1	.9	.8	8.6	13.7	25.1	48.1	26.8	l	6.8	--	--	49.1	27.0	16.0
8	A12	25-48	.4	.6	.8	7.8	12.9	22.5	47.3	30.2	cl	6.6	--	--	49.9	28.3	15.7
9	A13	48-94	.6	.7	.7	8.2	13.3	23.5	47.0	29.4	cl	16.3	--	--	47.7	26.7	15.8
10	B2	94-119	.9	1.6	1.1	12.6	15.6	31.8	31.8	36.4	cl	19.3	--	--	46.2	24.7	16.0
11	C	>119	0	.3	.9	13.7	16.3	31.2	32.4	36.5	cl	20.4	--	--	55.9	25.3	16.5

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 2

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of <2mm →														
12	A1	0-12	.8	1.9	2.2	17.1	23.6	45.6	36.7	17.7	l	2.3	--	--	39.5	17.7	8.3
13	B1	12-28	.2	1.0	2.0	15.2	18.0	36.4	32.2	31.3	cl	12.9	--	--	41.8	22.8	13.9
14	B2t	28-58	.1	.3	1.0	9.0	15.9	26.3	42.0	31.8	cl	19.2	--	--	46.4	26.6	16.3
15	B3ca	58-84	.1	.4	.8	8.2	16.6	26.0	48.0	25.9	l	28.8	--	--	40.4	24.1	14.4
16	C1ca	84-104	.1	.9	1.8	11.4	17.8	32.0	44.4	23.6	l	12.3	--	--	43.4	21.9	12.3
17	IIC2ca	104-127	1.2	4.7	7.8	22.4	16.8	52.9	25.3	22.0	scl	27.9	--	5.6	31.5	14.7	8.4
18	IIC3ca	127-150	2.7	8.1	14.0	26.5	13.9	65.2	20.7	14.1	sl	45.5	ll	--	25.1	10.9	6.5
19	IIICR	150-195	0	.1	.1	1.7	11.4	13.3	54.3	32.3	sicl	x	x	x	44.6	24.7	14.4

Site No. 3

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

x - Soft shale

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
20	A11	0-13	.5	1.1	.7	3.5	16.3	22.1	52.1	25.6	sil	8.8	--	--	36.1	22.0	13.0
21	A12	13-28	0	.1	.1	1.4	9.3	12.9	56.1	30.7	sicl	5.1	--	--	42.8	26.1	17.7
22	B2	28-56	.4	.5	.4	2.0	10.1	13.4	52.8	33.7	sicl	16.3	--	--	45.1	24.9	17.0
23	B3ca	56-82	.4	.6	.4	.8	8.1	10.3	52.5	37.2	sicl	8.7	--	--	49.9	24.1	17.6
24	C1ca	82-134	.1	.1	.2	1.3	10.3	12.0	54.2	33.9	sicl	16.3	--	--	54.4	25.0	17.2
25	C2ca	134-183	.2	.6	.5	1.9	9.4	12.6	55.2	32.2	sicl	11.7	--	--	43.9	22.6	16.0

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 4

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
26	A21	0-10	.6	.6	.5	5.3	16.6	23.7	48.9	27.4	cl	7.3	--	--	36.9	25.1	14.1
27	A22	10-23	.2	.3	.4	3.6	15.6	20.1	54.7	25.2	sil	7.8	--	--	36.8	22.9	12.8
28	B21t	23-43	.1	.3	.4	4.1	13.4	18.3	48.1	33.7	sicl	13.0	--	--	38.7	24.4	15.2
29	B22t	43-56	.1	.2	.4	4.3	13.0	18.0	49.2	32.9	sicl	16.1	--	--	42.2	25.2	17.2
30	B23ca	56-112	.2	.3	.3	5.1	14.6	20.5	45.4	34.1	cl	15.6	--	--	49.3	22.7	15.7
31	C	112-173	.1	.2	.2	4.6	13.4	18.5	49.7	31.6	sicl	19.0	--	--	43.6	22.9	14.7

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 5

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of <2mm →														
32	A11	0-5	.6	.6	.4	2.3	15.6	19.5	53.8	26.7	sil	.8	--	--	44.9	24.2	12.8
33	A12	5-15	.4	.5	.2	1.5	13.9	16.6	47.4	36.0	sicl	10.0	--	--	43.3	25.5	15.1
34	B21	15-25	.5	.5	.2	.7	11.8	13.7	50.0	36.3	sicl	--	--	--	46.2	25.9	15.4
35	B22	25-42	.1	.2	.2	.5	9.1	10.1	51.8	38.1	sicl	18.8	--	--	40.8	23.7	14.1
36	B3ca	42-76	.1	.1	.1	.5	11.3	12.1	54.8	33.1	sicl	15.1	--	--	39.1	20.6	12.1
37	CR	> 76	.0	.2	.1	.5	11.1	11.9	56.8	31.3	sicl	x	x	x	40.7	18.5	13.0

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 6

x - shale

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of <2mm →														
38	A11	0-23	1.4	1.1	1.6	11.9	17.4	33.4	45.0	21.6	l	15.1	--	--	41.9	22.5	13.1
39	A12	23-56	.6	1.1	2.0	12.3	17.7	33.7	46.0	20.3	l	22.2	--	6-17	38.5	20.6	12.7
40	B1	56-82	1.7	1.6	1.5	10.7	14.8	30.3	48.8	20.9	l	37.4	17.0	6.6	35.0	21.5	12.2
41	B2t	82-124	.7	.9	.9	7.0	13.1	22.6	52.9	24.5	sil	18.2	14.3	6.6	33.1	20.1	12.6
42	C	124-193	.9	2.1	.9	14.6	17.5	36.0	42.1	21.9	l	25.5	34.0	55.0	30.4	18.9	10.6

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 7

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of <2mm →														
43	Ap	0-25	.9	.7	.6	7.8	16.1	26.1	47.1	26.7	l	20.5	--	--	38.8	21.5	12.5
44	B21t	25-46	2.1	1.3	.9	9.5	16.8	24.6	40.2	35.1	cl	13.7	--	--	39.4	24.8	15.1
45	IIB22tb	46-65	2.3	1.3	1.4	15.1	18.7	38.8	33.7	27.5	cl		17	3.7	40.7	24.7	14.7
46	IIB3cab	65-91	2.9	1.6	1.8	20.5	18.7	45.5	27.7	26.6	scl	50.3	25	3.7	34.3	18.1	12.2
47	IIC1cab	91-162	4.3	4.4	2.8	17.7	17.4	46.6	29.6	23.8	l	22.47	18	3.7	33.3	16.3	10.3
48	IIC2b	162-175	4.8	4.6	6.9	34.1	14.4	64.8	19.0	16.1	sl	55.2	25	3.7	30.3	13.0	7.4
49	IIIA2b	175-190	.2	.3	.3	5.4	13.7	19.9	49.6	30.4	sicl	14.7	--	--	36.4	25.3	14.6
50	IIIB2tb	190-235	.2	.5	.6	10.3	21.7	33.3	38.8	27.9	cl	16.16	--	--	36.5	25.6	10.2
51	IIIC1cab	235-262	.6	.8	.8	10.7	22.5	35.4	39.9	24.7	l	17.1	--	--	38.3	23.5	13.2
52	IIIC2b	262-290	.6	.6	.7	10.1	22.4	34.4	40.6	24.9	l	12.8	--	--	38.2	25.5	14.2

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 8

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
53	A11	0-13	.1	.3	.3	8.4	27.6	36.7	45.0	18.3	l	2.4	--	--	46.6	21.3	10.1
54	A12	13-36	.4	.4	.5	10.8	20.6	32.7	44.7	22.6	l	1.6	--	--	43.3	23.2	11.7
55	B21t	36-66	.3	.3	.4	8.7	17.8	27.5	38.0	34.6	cl	10.7	--	--	41.2	25.4	13.8
56	B22t	66-99	0	.1	.2	7.1	17.5	25.0	38.6	36.4	cl	5.3	--	--	47.9	26.7	15.6
57	C	99-117	.2	.2	.3	11.2	27.5	39.4	37.7	22.9	l	15.1	--	--	39.2	22.0	11.0
58	CR	117-152	.4	.4	1.0	18.0	24.5	44.3	32.7	22.9	l	x	x	x	34.7	17.8	7.0

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

x - Soft calcareous shale

Site No. 9

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of <2mm →														
59	A1	0-8	.6	.4	.4	8.5	19.0	28.9	42.4	28.6	cl	10.4	--	--	64.8	33.7	20.0
60	B21t	8-18	.9	.2	.2	4.4	10.7	16.4	42.4	41.1	sic	16.4	--	--	46.1	27.7	18.4
61	B22t	18-28	.6	.5	.3	2.9	6.6	10.9	37.1	52.0	c	18.6	--	--	52.1	29.3	20.4
62	B23t	28-66	.1	.1	.1	1.4	3.0	4.7	41.7	53.5	sic	14.8	--	--	54.2	30.1	20.6
63	B3	66-87	.1	.2	.2	.6	4.6	5.7	50.7	43.5	sic	7.3	--	--	48.4	26.2	17.1
64	C	87-128	.2	.1	.2	.9	3.8	5.2	50.6	44.2	sic	43.1	--	--	46.7	23.5	15.0
65	CR	128-158	0.0	.1	.1	.5	4.6	5.3	53.4	41.4	sic	x	x	x	45.5	23.0	14.6

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 10

x - Soft shale

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
66	A11	0-18	.1	1.2	.8	34.0	28.8	64.9	21.6	13.5	sl	--	--	--	43.6	15.2	9.2
67	A12	18-36	0	.5	.9	37.9	31.0	70.3	19.9	9.8	sl	--	--	--	34.8	13.2	7.7
68	B1	36-68	.3	.3	.7	37.6	28.6	67.5	18.5	13.9	sl	4.8	--	--	31.6	14.7	7.8
69	B21t	68-120	.3	.3	.5	29.7	28.3	59.1	19.5	21.4	scl	8.9	--	--	37.2	18.6	10.5
70	B22t	120-158	0	.2	1.2	39.3	25.3	66.0	15.5	18.4	sl	--	--	--	36.7	13.8	9.0
71	B3	158-190	.1	.5	1.6	43.9	24.4	70.5	15.1	14.3	sl	--	--	--	36.3	12.2	7.2
72	CR	190-219	.1	.5	.8	50.7	26.2	78.3	11.0	10.6	sl	x	x	x	30.4	9.7	5.2

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 11

x - Soft non-calcareous sandstone

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
73	A2	0-13	.4	1.3	2.1	33.8	31.2	68.8	23.9	7.3	sl	--	--	--	30.0	10.6	4.4
74	B2t	13-28	.2	1.2	3.1	31.0	24.0	59.5	19.4	21.1	scl	10.3	--	--	37.4	33.1	23.5
75	B3ca	28-46	.2	2.0	5.1	35.3	26.9	69.5	15.6	14.9	sl	8.6	--	--	46.9	29.6	20.4
76	C1	46-64	.6	6.9	14.7	42.7	19.3	84.2	7.7	8.1	ls	6.7	--	--	28.6	17.1	8.6
77	C1C2	64-152	1.9	11.0	15.3	39.3	18.6	86.1	7.6	6.3	ls	46.9	37.9	44.0	28.7	12.5	6.6

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 12

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
78	A1	0-12	1.5	1.5	1.3	4.7	25.7	34.7	46.9	18.4	l	--	--	--	42.2	20.5	9.6
79	B21t	12-25	1.0	.8	.5	2.6	15.3	20.2	36.9	42.9	c	7.2	--	--	43.9	24.8	16.6
80	B22t	25-40	.2	.3	.4	2.3	17.7	20.9	45.5	33.5	cl	19.0	--	--	44.6	24.2	15.8
81	B3ca	40-71	.7	.6	.6	3.1	20.6	25.1	47.1	27.7	cl	22.3	--	--	36.1	23.2	14.8
82	Cca	71-112	1.5	1.9	1.4	4.4	21.2	30.4	42.8	26.8	l	17.5	--	--	36.6	21.6	13.3
83	C	112-165	.7	2.0	1.6	5.4	22.8	32.5	43.6	23.8	l	15.7	--	--	36.3	20.4	11.9

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 13

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
84	A1	0-13	.8	1.4	2.2	11.0	8.0	23.4	52.7	23.9	sil	3.6	--	--	46.5	30.3	16.7
85	B2	13-31	.8	1.4	1.4	9.7	7.3	20.6	54.2	25.2	sil	11.5	--	--	42.1	27.9	16.1
86	B31	31-45	.3	.9	1.5	9.9	6.2	18.8	54.7	26.5	sil	14.3	--	--	40.7	27.2	15.4
87	B32	45-74	.1	.2	.1	.5	3.4	4.3	66.2	29.5	sicl	48.1	25.0	--	44.6	30.8	17.1
88	R	74-100	1.1	4.2	1.5	1.5	1.4	9.6	59.9	30.5	sicl	x	x	x	44.4	30.5	17.0

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

x - Shale and sandstone

Site No. 14

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
89	A11	0-36	2.7	2.3	3.2	13.7	13.3	35.2	43.4	21.4	l	5.1	--	--	56.1	29.7	16.9
90	A12	36-104	2.0	2.0	2.5	11.4	11.0	29.0	45.3	25.7	l	7.4	--	--	50.4	31.1	17.6
91	C	104-162	1.1	1.3	2.4	16.0	13.3	34.2	43.1	22.7	l	7.7	--	--	46.0	27.8	15.6
92	A1b	162-184	3.8	2.4	2.7	12.9	11.3	33.1	43.0	23.9	l	4.1	--	--	46.2	28.4	16.8

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 15

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
93	A11	0-20	1.2	2.5	10.2	20.9	10.2	45.0	32.9	22.1	l	--	--	--	46.4	24.8	15.1
94	A12	20-38	1.8	4.5	12.1	23.0	9.6	51.3	28.1	20.6	l	--	--	--	38.1	21.0	13.9
95	A13	38-71	1.0	3.2	16.2	23.5	8.1	52.0	28.5	19.4	sl	--	--	--	39.3	22.5	13.4
96	C1	71-132	3.6	7.1	24.5	32.5	7.5	75.2	14.4	10.3	sl	6.9	40.0	--	38.8	21.2	13.2
x	R	>132															

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 16

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
97	A1	0-15	3.1	4.2	9.9	24.8	12.9	54.9	24.1	21.0	scl	2.28	50.0	--	50.6	22.5	15.2
98	B2	15-44	.5	.8	.7	5.8	30.2	38.0	44.3	17.7	l	40.8	40.0	34.0	50.0	26.3	17.3
x	R	>44															

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 17

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
99	A11	0-15	1.7	1.3	2.0	8.6	8.8	22.0	48.3	29.7	cl	5.0	--	--	59.2	34.6	20.8
100	A12	15-64	1.8	2.2	2.0	8.6	8.8	23.3	43.6	33.0	cl	8.4	--	--	53.7	30.7	21.3
101	B2t	64-126	2.6	2.8	2.0	6.7	6.5	20.7	45.7	33.6	cl	23.6	24.0	21.0	52.4	36.6	26.7
x	R	>126															

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 18

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
102	At	0-13	.2	.7	2.3	11.0	17.7	31.9	41.9	26.1	l	--	--	--	40.5	22.6	14.1
103	B2t	13-28	.1	.5	1.9	8.6	13.2	24.3	48.3	27.5	cl	21.0	--	--	41.8	25.3	16.5
104	B3ca	28-61	.1	.4	2.1	8.7	13.2	24.5	50.8	24.7	sil	19.6	--	--	43.0	27.3	17.0
105	Cca	61-99	.2	.7	2.2	11.6	15.6	30.3	45.3	24.4	l	7.5	--	--	36.3	26.1	16.5
106	B21tcab	99-144	.4	.9	1.7	9.4	14.2	26.6	55.8	17.6	sil	2.7	--	--	38.2	29.8	16.9
107	B22tcab	144-190	.2	.9	2.1	12.2	13.6	29.0	45.4	25.6	l	2.2	--	--	45.8	31.6	18.8
108	B23tcab	190-206	.1	.6	1.6	10.4	15.3	28.0	43.6	28.4	cl	9.6	--	--	43.2	30.1	17.5
109	Ccsb	>206	0	.4	1.7	11.8	16.2	30.1	43.1	26.7	l	5.5	--	--	45.1	27.8	16.2
x	R																

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 19

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
110	A1	0-10	.8	2.0	5.8	26.5	14.3	49.4	32.3	18.3	l	--	--	6-17	47.5	22.8	12.9
111	AC	10-27	1.7	2.7	3.2	15.2	19.2	42.0	39.2	18.9	l	7.94	--	--	45.1	25.8	17.0
112	Cr	27-40	1.7	1.6	1.3	11.8	19.7	36.1	41.5	22.5	l	32.18	40.0	--	58.7	33.4	18.5
113	R	>40	.3	.6	1.5	27.3	29.1	58.8	29.3	12.0	sl	x	x	x	40.2	21.4	8.8

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

x - Sandstone

Site No. 20

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
115	A1	0-15	9.7	9.5	10.8	27.0	13.5	70.5	16.9	12.5	sl	26.2	--	--	35.6	15.1	9.4
116	C1	15-41	3.9	6.0	11.2	34.1	18.6	73.8	19.4	6.9	sl	23.9	--	--	35.8	14.5	8.9
117	C2	41-54	6.5	8.4	12.1	30.2	16.5	73.7	20.2	6.1	sl	44.6	28.0	--	34.4	15.9	9.9
118	C3	54-94	8.4	9.0	13.2	31.4	14.6	76.6	16.7	6.6	ls/sl	27.4	--	--	35.9	12.8	8.0
119	A1b	94-107	3.5	6.3	12.3	37.1	16.6	75.8	17.0	7.1	sl	11.6	--	--	34.5	12.1	8.0
120	IIC1	107-127	4.0	8.6	12.4	33.1	16.2	74.3	18.1	7.5	sl	21.1	--	--	35.0	11.6	7.5
121	IIC2	127-153	10.5	12.8	18.5	32.3	9.7	83.8	10.1	6.1	ls	35.9	--	--	34.9	11.1	7.3
122	IIIC1	153-180	13.9	11.1	14.7	29.1	11.6	79.5	15.0	5.4	ls	44.6	5	--	34.7	15.4	8.2

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 21

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture				Moisture Content %		
			Sand*					Total				Coarse Fragments					
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
123	A1	0-30	.2	.3	.7	12.0	23.9	37.1	56.2	6.9	sil	--	--	--	48.6	22.1	11.5
124	A1b	30-46	.3	.8	1.3	11.5	20.2	34.1	50.7	15.1	sil	--	--	--	48.8	24.6	12.0
125	IIC1	46-99	.4	.8	1.5	12.5	17.5	32.7	52.6	14.5	sil	--	--	--	44.4	25.1	12.7
126	IIIA1b	99-110	.6	1.5	3.9	18.6	14.7	39.3	45.1	15.5	l	--	--	--	46.8	29.6	14.2
127	IIIC1	110-143	.7	2.4	6.1	32.6	20.8	62.6	27.7	9.7	sl	--	--	--	38.6	18.0	10.4
128	IIIC2	143-160	.1	1.3	7.9	41.6	22.5	73.4	20.9	5.6	sl	--	--	--	37.6	21.8	8.4
129	IVA1b	160-180	0	.2	.7	6.7	16.6	24.2	60.6	15.2	sil	--	--	--	44.2	26.3	13.3
130	IVC1	180-198	.1	.3	.7	8.5	19.9	29.5	55.2	15.3	sil	--	--	--	43.4	26.8	12.9

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 22

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
131	A2	0-8	.8	5.1	6.0	13.2	19.3	44.6	43.3	12.1	l	--	--	--	29.2	17.7	8.0
132	B2t	8-21	.2	1.3	2.1	5.2	9.4	18.2	40.6	41.2	sic	1.0	--	--	53.4	35.1	25.7
133	B3ca	21-41	.2	.8	1.9	5.3	11.1	19.3	50.0	30.7	sicl	1.9	--	--	48.8	31.7	20.4
134	C1ca	41-82	.2	1.3	3.2	8.3	14.1	27.1	49.1	23.8	l	4.3	--	--	46.4	28.6	17.9
135	C2	82-152	.2	1.7	3.2	9.0	15.8	29.9	47.0	23.0	l	--	--	--	42.1	27.1	14.8
136	IIC1ca	152-200	.3	1.6	3.2	9.9	17.4	32.4	46.4	21.2	l	--	--	--	38.3	27.2	14.8

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 23

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
137	A1	0-10	.6	4.0	6.3	12.9	18.5	42.1	35.5	22.1	l	--	--	--	38.8	20.1	11.6
138	B2	10-26	.1	.9	2.5	6.2	11.5	21.2	48.6	30.2	cl	--	--	--	43.3	27.5	17.8
139	B3ca	26-39	.2	1.0	1.9	5.1	11.5	19.7	52.9	27.3	sicl	--	--	--	47.9	28.1	17.0
140	Cca	39-92	.3	1.7	3.4	8.2	14.7	28.3	47.4	24.3	l	--	--	--	38.2	27.8	17.2
141	C	92-143	.1	1.4	3.0	9.8	16.8	31.1	45.1	23.9	l	--	--	--	42.1	29.9	16.6
142	IICca	143-200	.2	1.2	1.4	9.0	16.4	28.2	46.2	25.5	l	--	--	--	43.6	27.2	15.6

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 24

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
143	Ap	0-13	.1	.1	.1	.6	3.2	4.1	55.4	40.6	sic	--	--	--	64.1	46.3	27.0
144	A11	13-37	.3	.1	.2	.7	3.2	4.5	54.6	40.9	sic	--	--	--	63.0	41.6	27.8
145	A12	37-69	0	.2	.2	.8	3.3	4.5	60.1	35.5	sicl	--	--	--	56.4	41.2	29.7
146	C1	69-80	.1	.5	1.6	31.4	21.9	55.5	29.0	15.5	sl	--	--	--	41.0	19.7	11.6
147	C2	80-104	.1	.1	.2	1.8	5.0	7.2	57.2	35.6	sicl	--	--	--	57.1	39.2	24.0
148	A1b	104-122	0	.1	.2	2.4	7.5	10.2	53.5	36.3	sicl	--	--	--	59.7	41.5	24.6
149	IIC1g	122-158	8.5	7.2	10.6	17.5	9.0	52.8	29.1	18.1	sl	20.9	--	--	33.5	24.2	14.5
150	IIC2g	158-204	1.8	3.6	5.1	16.7	17.3	44.5	39.9	17.4	l	7.9	--	--	35.8	24.8	13.8

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 25

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
151	A1	0-13	2.2	2.6	4.0	29.0	18.2	56.0	24.3	19.6	sl	41.6	10.0	10.0	52.4	28.6	18.4
152	C1	13-23	3.4	3.3	5.6	32.1	19.3	63.7	25.5	10.7	sl	44.1	20.0	--	55.4	24.0	16.1
153	C2	23-41	3.7	3.3	3.6	15.6	22.5	48.7	40.9	10.5	l	44.6	25.0	5.0	49.4	30.1	16.3
154	R	>41	5.7	6.2	6.2	21.7	23.6	63.4	28.2	8.4	sl	56.9	27.0	25.0	42.1	22.7	11.1

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 26

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
155	A1	0-11	3.4	3.4	1.9	12.1	19.7	40.5	37.8	21.6	1	11.5	--	--	46.3	23.3	14.5
156	B2	11-30	4.0	3.4	2.0	11.5	19.0	39.9	39.5	20.5	1	12.0	--	--	44.9	23.3	14.0
157	C1	30-56	4.3	4.1	2.3	11.2	17.5	39.4	42.2	18.3	1	13.4	--	--	43.1	23.9	14.5
x	R	>56															

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 27

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of <2mm →														
159	A1	0-8	.2	.3	.5	7.2	7.6	15.8	49.4	34.8	sicl	3.5	--	--	62.1	32.4	19.0
160	B21	8-15	.1	.3	.3	3.7	3.4	7.9	34.4	57.8	c	15.2	--	--	58.4	30.2	21.2
161	B22	15-46	.1	.2	.3	4.0	4.0	8.6	37.5	53.9	c	9.4	--	--	48.7	26.8	17.5
162	B3	46-71	.1	.1	.3	3.8	3.6	7.9	39.8	52.2	c	3.1	--	--	47.2	28.1	17.7
163	C	71-81	0	.1	.2	2.2	2.1	4.6	46.1	49.3	sic	13.3	--	--	47.0	28.0	17.8
164	CR	>81	.1	.1	.1	.2	.4	.9	52.1	47.0	sic	x	x	x	51.8	24.8	15.4

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

x - Platy soft weathered shale

Site No. 28

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
165	A11	0-36	4.2	6.8	9.8	19.2	8.6	48.6	25.2	26.2	scl	9.8	--	--	47.1	25.1	13.5
166	A12	36-66	.6	.9	.6	5.0	29.3	36.3	45.1	18.6	l	6.9	--	--	42.8	20.7	11.1
167	A2b	66-77	.7	.7	.6	5.5	24.5	31.9	47.4	20.7	l	16.0	--	--	33.7	19.5	10.8
168	B&Ab	77-118	.3	.4	.3	4.7	17.8	23.6	48.0	28.3	cl	23.8	--	--	40.9	23.8	13.7
169	B21b	118-178	.2	.2	.3	4.1	17.3	22.1	47.7	30.2	cl	22.4	--	--	43.0	26.5	15.1
170	B22b	178-234	.6	.7	.6	5.6	22.9	30.3	42.5	27.2	cl	11.9	--	--	41.9	26.7	13.9
171	C	234-254	.6	.5	.4	5.5	20.8	27.8	49.0	23.1	l	22.6	--	--	40.9	25.6	12.5
x	R	> 254															

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 29

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
172	A11	0-13	1.0	.6	.3	2.0	22.4	26.3	53.4	20.2	sil	11.7	--	--	52.3	25.5	14.0
173	A12	13-47	.8	.6	.6	2.7	21.8	26.5	52.8	20.7	sil	10.8	--	--	50.1	23.6	12.3
174	A13	47-89	1.0	1.0	.8	2.7	22.0	27.4	53.1	19.5	sil	11.6	--	--	46.8	24.1	11.4
175	B	89-127	.3	.5	.3	2.0	21.0	24.1	53.3	22.5	sil	12.5	--	--	42.4	24.5	11.6
x	Cr	>127															

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 30

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
176	A1	0-8	.2	.1	.1	.6	3.8	4.9	41.3	53.8	sic	5.3	--	--	59.1	34.6	22.6
177	B21	8-26	.2	.2	.1	.6	2.8	3.9	37.3	58.7	c	14.0	--	--	58.5	34.8	24.0
178	B22	26-89	0	.1	.1	.5	2.3	3.0	37.7	59.3	c	19.0	--	--	74.3	40.4	27.0
179	B3cacs	89-122	.1	.1	.2	.4	1.9	2.7	89.6	7.7	si	7.3	--	--	51.6	26.9	20.2
x	Cr	122-148															

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 31

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
180	A2	0-5	1.1	.4	.4	2.1	3.4	12.4	66.2	21.4	sil	6.2	--	--	48.6	28.9	13.3
181	B21t	5-23	.1	.1	.1	.8	4.8	6.1	54.8	39.8	sicl	18.9	--	--	62.0	31.4	21.1
182	B22tsa	23-64	.1	.1	.1	.5	3.3	4.1	55.9	40.0	sic	13.2	--	--	56.0	30.1	20.3
183	B3sa	64-104	.1	.1	.1	2.3	4.5	7.2	44.9	47.9	sic	10.9	--	--	61.5	32.7	22.8
184	Csacs	104-155	.1	.1	.2	2.3	4.9	7.7	44.3	48.0	sic	10.2	--	--	62.0	32.9	22.8

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 32

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
185	A1	0-13	.2	.2	.2	1.1	3.1	4.8	56.5	38.8	sicl	8.1	--	--	82.1	48.5	36.4
186	C1	13-23	.2	.4	.7	26.8	39.8	67.9	25.0	7.0	sl	1.7	--	--	32.4	11.2	7.2
187	A1bg	23-69	0	.1	.2	1.8	6.0	8.1	57.8	34.2	sicl	7.9	--	--	61.8	36.4	26.4
188	C2b1g	69-94	.1	.1	.1	1.7	8.5	10.5	58.8	30.6	sicl	5.5	--	--	64.0	36.1	24.1
189	C3b2g	94-119	.1	.3	1.8	22.2	27.3	51.7	34.2	14.0	l	1.2	--	--	38.7	18.9	12.5

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 33

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
190	A1	0-5	2.6	3.0	2.3	26.3	24.5	60.5	30.2	9.3	sl	6.3	--	--	35.8	20.5	13.8
191	A2	5-10	1.1	1.2	.9	13.6	18.0	34.7	46.3	18.9	l	8.1	--	--	34.5	19.1	10.3
192	B&A	10-23	.7	.8	1.3	9.3	15.4	27.5	38.0	34.5	cl	10.4	--	--	41.4	23.2	15.4
193	B21t	23-39	.2	.4	.7	6.4	10.6	18.3	31.3	52.2	c	20.1	--	--	59.7	33.8	21.3
194	B22t	39-56	0	.1	.1	2.6	11.4	14.2	35.9	49.8	c	5.4	--	--	57.1	29.4	20.8
195	B3tca	56-79	.1	0	0	1.8	14.8	16.7	41.2	42.2	sic	1.1	--	--	54.4	25.6	18.2
196	Cca	79-100	0	.1	0	.1	3.9	4.1	51.7	44.1	sic	4.4	--	--	48.2	24.3	17.2
197	Ccs	100-153	0	0	0	.2	3.6	3.8	49.7	46.4	sic	33.2	--	--	58.1	26.2	18.4
198	Cr	153-165	0	.1	0	.4	2.9	3.4	42.3	54.4	sic	31.1	--	--	57.3	27.4	19.6

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 34

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of < 2mm →														
199	A1	0-7	.3	.8	.7	6.7	19.2	27.7	44.5	27.8	cl	--	--	--	56.2	26.7	19.1
200	B1	7-20	.6	1.0	.7	6.1	16.6	25.0	45.2	29.7	cl	--	--	--	44.6	25.7	16.2
201	B21t	20-38	.5	.5	.3	3.3	12.9	17.9	41.7	40.3	sic	12.5	--	--	40.2	27.0	18.5
202	B22t	38-68	.2	.5	.3	1.8	9.8	12.6	38.1	49.3	c	27.8	--	--	47.8	28.4	21.3
203	B31ca	68-81	.2	.7	.4	2.1	7.4	10.8	40.7	48.5	sic	22.9	--	--	48.3	28.6	20.5
204	B32ca	81-107	.1	.4	.3	2.9	10.9	14.6	43.4	42.0	sic	25.6	15	--	43.1	26.4	18.7
205	Cca	107-130	.1	.3	.2	3.3	13.6	17.5	39.4	43.1	c	20.4	25	--	53.4	32.8	22.8
206	R	130-163	.1	.7	.8	5.1	28.7	35.4	35.7	28.9	cl	x	x	x	43.2	22.9	13.2

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

x - Sandstone

Site No. 35

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Size Class and Particle Diameter (mm)								Texture	Coarse Fragments			Moisture Content %		
			Sand*					Total									
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.1	VFS .1-.05	Sand 2-.05	Silt .05-.002	Clay <.002		2-19 pct. of <19mm	19-75 pct. of <75mm	>75** pct. of whole soil	0 Bar	.33 Bar	15 Bar
			← Pct. of <2mm →														
207	A1	0-15	.4	.6	.7	5.9	10.5	18.1	47.3	34.6	sicl	2.5	--	--	75.4	32.7	22.4
208	A3	15-31	.1	.5	.5	5.3	11.3	17.7	46.3	35.9	sicl	4.0	--	--	60.7	31.8	21.3
209	B21t	31-66	.2	.5	.4	3.2	10.8	15.1	40.5	44.4	sic	31.5	--	--	47.8	30.9	20.3
210	B22t	66-94	.1	.5	.6	7.3	12.8	21.3	44.9	33.7	cl	23.8	--	--	44.9	29.4	17.3
211	IIC	94-112	1.1	1.7	1.9	12.6	18.4	35.6	37.8	26.5	l	29.6	30.0	--	46.3	24.6	13.7
212	IIICca	112-150	0	0	0	.1	3.0	3.1	48.0	49.0	sic	20.4	--	--	55.6	28.6	19.7

* VCS - Very Coarse Sand
CS - Coarse Sand
MS - Medium Sand
FS - Fine Sand
VFS - Very Fine Sand

Site No. 36

Appendix Table A-4. (continued)

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
1	A11	0-18	.5	2.9	0.6	0.9	.5	0	2.7	.1	.8	.9	.7	29.4	24.0	1.8	.5	.7	1.7	<1	1.0
2	A12	18-64	.5	2.2	0.2	1.9	.3	0	2.8	.9	.4	.6	1.7	25.8	20.9	1.1	1.0	.6	3.9	<1	.8
3	A2	64-71	.3	2.0	0.4	.5	.2	0	1.2	<.1	.7	.6	.5	9.6	7.2	1.0	.2	.2	2.1	<1	.2
4	B&A	71-99	.3	1.5	0.2	.7	.1	0	1.1	.1	.7	.2	.8	10.0	7.5	.7	.3	.2	3.0	<1	.2
5	B2t	99-130	.2	1.0	.03	.4	.1	0	.5	.3	.4	.2	.6	12.6	9.2	1.2	.3	.2	2.4	<1	.2
6	C	130-180	.2	0.8	.02	.7	.1	0	.3	.6	.4	.3	.4	12.8	8.4	1.3	.4	.2	3.1	<1	.2

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
1	A11	0-18	6.7	8.9	.494	10.5	10	283	.65	4.4	88.0	1.0	32.1
2	A12	18-64	6.9	6.6	.340	11.3	8	230	.58	.8	65.8	1.0	28.7
3	A2	64-71	7.0	1.2	.073	8.9	2	70	.19	.3	12.3	.2	12.8
4	B&A	71-99	6.8	.9	.069	7.6	3	87	.19	.3	13.8	1.2	11.1
5	B2t	99-130	6.0	.6	.061	5.7	2	93	.42	.3	37.0	3.0	14.4
6	C	130-180	5.4	.5	.046	6.3	2	88	.28	.2	25.1	2.6	4.8

Appendix Table A-5. Chemical characterization data of all horizons of soils studied.

Site No. 1

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/l)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
7	A11	0-25	.7	2.8	.7	3.5	.7	0	2.1	4.0	.5	1.1	2.7	24.1	17.5	1.6	.5	1.0	2.1	<1	.8
8	A12	25-48	.8	3.7	1.0	2.7	.7	0	2.5	2.2	3.0	.4	1.8	22.8	16.8	1.7	.9	.8	4.0	<1	.4
9	A13	48-94	.5	2.2	.6	1.4	.3	0	1.8	2.4	.3	.2	1.2	20.2	15.3	2.2	.6	.6	3.0	<1	.2
10	B2	94-119	.2	1.2	.2	.3	.1	0	1.0	.1	.4	.1	.4	23.0	15.1	3.8	.5	.3	2.2	<1	.8
11	C	>119	.2	1.2	.2	.4	.1	0	1.2	.4	.2	.1	.5	24.0	16.0	4.1	.3	.3	1.3	<1	.6

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
7	A11	0-25	6.8	5.5	.290	11.0	14	388	.45	4.3	52.6	1.2	40.3
8	A12	25-48	7.1	3.9	.277	8.2	12	333	.42	3.3	42.2	1.3	39.8
9	A13	48-94	6.8	3.6	.228	9.2	16	255	.49	2.2	55.4	1.4	41.8
10	B2	94-119	6.5	.9	.075	7.0	7	120	.25	.2	13.1	1.1	8.5
11	C	>119	6.6	.7	.071	5.7	8	108	.35	.2	15.2	2.3	11.4

Appendix Table A-5. (continued)

Site No. 2

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/l)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
12	A1	0-12	.6	3.8	2.0	.3	.3	0	5.2	.1	.2	.2	.2	14.1	10.6	2.3	.3	.4	2.1	<1	1.0
13	B1	12-28	.3	1.9	1.2	.3	.1	0	2.3	<.1	.2	.2	.2	20.6	13.3	6.5	.3	.4	1.5	<1	1.0
14	B2t	28-58	.3	1.5	1.2	.4	.1	0	2.0	<.1	.3	.2	.3	23.7	14.7	8.4	.2	.4	.8	<1	1.2
15	B3ca	58-84	.4	1.6	1.6	.6	.1	0	2.4	<.1	.4	.2	.5	20.0	x	x	.5	.3	2.5	<1	14.6
16	C1ca	84-104	.3	1.0	1.6	.7	.1	0	2.5	<.1	.2	.2	.6	15.4	x	x	.5	.3	3.3	<1	12.6
17	II C2ca	104-127	.4	1.0	2.2	1.1	.1	0	3.1	<.1	.3	.2	.9	11.7	x	x	.3	.2	2.6	<1	9.2
18	II C3ca	127-150	.5	.7	2.0	1.4	.1	0	3.3	.1	.3	.1	1.2	9.9	x	x	.5	.2	5.1	<1	7.6
19	IIIC	150-195	1.0	.6	2.8	8.2	.2	0	4.1	3.5	3.7	.2	6.3	21.0	x	x	1.7	.4	8.1	<1	10.4

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
12	A1	0-12	7.8	1.5	.098	8.9	21	158	.30	.7	13.3	1.2	13.0
13	B1	12-28	7.4	1.1	.084	7.6	1	160	.14	.2	9.5	1.2	11.5
14	B2t	28-58	7.3	1.0	.090	6.5	1	145	.21	.2	7.8	.8	9.3
15	B3ca	58-84	8.4	.7	.064	6.4	1	105	.27	.2	4.2	.8	5.0
16	C1ca	84-104	8.6	.6	.056	6.2	1	107	.41	.2	4.4	.8	4.5
17	II C2ca	104-127	8.7	.4	.035	6.7	1	65	.38	.3	2.4	.5	3.1
18	II C3ca	127-150	8.8	.3	.024	7.3	2	63	.27	.3	1.5	.3	3.1
19	IIIC	150-195	8.9	.5	.042	6.9	11	123	.71	.3	4.8	1.4	2.4

Appendix Table A-5. (continued)

Site No. 3

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/l)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
20	A11	0-13	.5	2.9	1.5	.4	.6	0	4.1	<.1	.3	.4	.3	19.1	x	x	.1	.7	.5	<1	9.6
21	A12	13-28	.5	2.0	2.3	1.0	.2	0	4.1	<.1	.5	.3	.7	21.1	x	x	.3	.5	1.4	<1	4.6
22	B2	28-56	.7	1.5	2.8	4.4	.2	0	4.0	2.6	1.5	.2	3.0	24.0	x	x	.6	.6	2.5	<1	8.0
23	B3ca	56-82	7.0	22.1	67.4	28.2	1.5	0	1.8	105.5	6.6	.1	4.2	20.8	x	x	1.8	.6	8.7	3.5	12.0
24	C1ca	82-134	14.0	21.6	118.5	48.2	2.1	0	1.6	171.9	10.9	.1	5.8	21.6	x	x	2.0	.7	9.3	2.8	15.6
25	C2ca	134-183	17.4	20.7	122.9	81.9	2.5	0	1.5	203.1	13.7	.08	9.7	16.0	x	x	1.9	.7	11.9	1.0	14.8

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
20	A11	0-13	8.4	1.3	.087	8.7	2	295	.28	.2	4.2	.5	5.4
21	A12	13-28	8.5	1.8	.122	8.6	2	210	.41	.2	5.0	.7	6.3
22	B2	28-56	8.6	1.3	.095	8.0	2	245	.46	.2	5.6	.7	5.2
23	B3ca	56-82	8.3	1.0	.084	6.9	2	278	.40	.2	5.6	.8	3.1
24	C1ca	82-134	8.5	.9	.080	6.5	3	313	.38	.1	6.4	.6	2.4
25	C2ca	134-183	8.6	.7	.064	6.4	7	308	.68	.2	7.1	.6	2.5

Appendix Table A-5. (continued)

Site No. 4

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
26	A21	0-10	1.1	2.8	.4	7.0	1.1	0	7.0	2.2	2.3	.07	5.5	16.9	x	x	1.1	1.5	6.5	1	5.0
27	A22	10-23	.7	2.1	.9	4.0	.6	0	5.5	.1	1.3	.07	3.3	16.2	14.0	3.6	.6	1.1	3.7	1	3.0
28	B21t	23-43	.6	2.0	1.0	4.2	.2	0	4.9	.1	1.7	.07	3.4	22.9	16.7	6.0	1.0	.6	4.4	1	3.4
29	B22t	43-56	.9	.9	.5	8.2	.2	0	6.9	.2	2.3	.13	9.8	23.7	x	x	3.0	.4	12.7	1	11.2
30	B23ca	56-112	5.6	2.3	9.1	54.6	.3	0	3.2	53.4	6.2	.05	22.9	19.1	x	x	4.1	.4	21.5	1	11.2
31	C	112-173	20.0	14.5	60.0	240.0	.7	0	2.2	276.0	21.4	.02	39.3	18.3	x	x	3.9	.4	21.3	1.1	10.0

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
26	A21	0-10	7.9	2.6	.165	9.2	21	580	.50	.5	6.1	.8	7.1
27	A22	10-23	8.1	1.2	.101	6.9	10	425	.33	.4	5.2	.8	6.3
28	B21t	23-43	8.1	1.0	.085	6.8	1	235	.52	.2	5.5	.7	6.4
29	B22t	43-56	8.5	.8	.075	6.2	3	153	.63	.2	5.8	.8	5.0
30	B23ca	56-112	8.6	.7	.066	6.2	4	140	.33	.2	6.5	.7	3.7
31	C	112-173	8.7	.6	.056	6.2	12	170	1.91	.3	6.9	1.0	2.2

Appendix Table A-5. (continued)

Site No. 5

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/l)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
32	A11	0-5	.6	4.0	2.3	.3	.5	0	5.9	.05	.4	.03	.2	20.5	13.3	4.5	.1	.8	.5	<1	3.8
33	A12	5-15	.4	2.8	1.8	.3	.2	0	3.8	0	.7	.03	.2	24.1	14.5	5.5	.1	.7	.4	<1	1.2
34	B21	15-25	.4	2.5	1.5	.3	.2	0	3.3	0	.4	.02	.2	25.9	18.0	5.7	.2	.6	.8	<1	1.0
35	B22	25-42	.4	2.2	1.5	.3	.2	0	3.3	0	.4	.02	.2	22.7	x	x	.3	.4	1.3	<1	14.6
36	B3ca	42-76	.3	1.8	1.6	.3	.2	0	3.1	0	.4	.02	.2	21.3	x	x	.3	.3	1.4	<1	12.8
37	CR	>76	.3	.9	1.4	.5	.1	0	2.5	.1	.3	.05	.5	15.5	x	x	.4	.24	1.3	<1	18.9

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
32	A11	0-5	7.3	3.6	.211	9.9	11	326	.68	.9	8.9	.9	2.9
33	A12	5-15	7.6	2.1	.165	7.4	10	285	.50	.4	5.2	.8	4.4
34	B21	15-25	7.4	2.0	.163	7.1	2	235	.64	.2	4.7	.7	3.5
35	B22	25-42	8.0	1.3	.112	6.8	2	156	.54	.1	4.0	.6	3.0
36	B3ca	42-76	7.9	1.1	.095	6.7	2	132	.37	.1	3.7	.6	2.0
37	CR	>76	8.4	.6	.052	6.7	1	93	.31	1.0	2.5	.6	1.7

Appendix Table A-5. (continued)

Site No. 6

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
38	A11	0-23	.5	2.8	.9	.9	.7	0	4.1	1.0	.4	.05	.7	22.0	17.4	1.4	.6	.2	2.7	1	1.4
39	A12	23-56	.5	2.5	.8	.9	.5	0	4.1	<.1	.5	.03	.7	17.9	13.9	1.3	.5	.2	2.8	1	1.0
40	B1	56-82	.4	2.1	.7	.9	.3	0	3.5	.1	.5	.02	.8	13.5	10.3	1.3	.3	.2	2.2	1	1.2
41	B2t	82-124	.3	1.7	.8	.6	.2	0	3.1	<.1	.4	.02	.5	12.4	9.3	1.4	.3	.1	2.4	1	1.4
42	C	124-193	.4	2.0	.9	.6	.2	0	2.8	.5	.4	.2	.5	10.5	7.7	1.4	.2	.1	1.9	1	1.2

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
38	A11	0-23	6.9	6.1	.259	13.7	19	250	.45	6.4	38.7	1.0	15.4
39	A12	23-56	7.3	3.7	.202	10.7	13	181	.39	3.6	31.7	1.1	11.9
40	B1	56-82	7.5	2.6	.131	11.5	13	128	.28	1.4	14.0	1.2	6.7
41	B2t	82-124	7.5	2.5	.111	13.1	11	118	.28	.6	11.7	1.2	5.2
42	C	124-193	7.5	1.5	.079	11.0	4	93	.14	1.3	9.2	1.4	4.3

Appendix Table A-5. (continued)

Site No. 7

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCo_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
43	Ap	0-25	.3	2.3	.6	.6	.2	0	3.2	<.1	.3	.07	.5	16.7	13.2	2.1	.2	.7	1.2	1	1.0
44	B21t	25-46	.4	2.9	.8	.7	.1	0	3.6	.1	.3	.02	.5	20.4	14.5	3.1	.2	.5	1.0	1	1.4
45	II B22tb	46-65	.4	3.0	.8	.6	.1	0	3.3	.1	.5	.02	.4	24.0	17.0	3.4	.2	.4	.8	1	1.4
46	II B3cab	65-91	.4	3.2	.7	.9	.1	0	3.3	.7	.6	.02	.7	18.8	x	x	.3	.3	1.6	1	6.4
47	II C1cab	91-162	.6	3.8	1.1	.8	.1	0	2.7	.6	.7	2.1	.5	14.9	x	x	.3	.3	2.0	1	16.8
48	IIC2b	162-175	.5	2.4	1.8	.8	.1	0	3.2	.6	.4	1.1	.6	9.5	x	x	.2	.1	2.1	1	8.6
49	III A2b	175-190	.5	2.3	2.0	.6	.1	0	3.0	.6	.4	1.4	.4	21.4	x	x	.3	.3	1.4	1	9.8
50	III B21b	190-235	.5	2.2	1.9	.9	.1	0	2.9	.6	.4	1.3	.6	18.6	14.1	7.7	.3	.4	1.6	1	3.0
51	III C1cab	235-262	.4	2.2	1.8	.7	.1	0	2.9	.5	.6	.9	.5	17.4	x	x	.3	.4	1.7	1	5.0
52	III C2b	262-290	.4	1.9	1.4	.6	.1	0	3.0	.4	.5	.5	.5	18.8	x	x	.4	.4	2.1	1	3.8
x	IVC3b	290-325																			

Site No. 8

Appendix Table A-5. (continued)

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
43	Ap	0-25	7.1	2.7	.160	9.8	22	273	.36	1.3	13.4	1.3	20.5
44	B2lt	25-46	7.3	1.4	.115	7.1	8	175	.25	.4	8.4	1.0	12.6
45	IIB22tb	46-65	7.4	1.1	.101	6.3	1	153	.24	.3	5.7	.9	5.9
46	IIB3cab	65-91	8.0	1.0	.076	7.6	2	115	.23	.3	2.9	.7	3.8
47	IIC1cab	91-162	8.0	.6	.045	7.8	6	100	.24	.2	1.9	.7	2.4
48	IIC2b	162-175	8.1	.3	.023	7.6	4	55	.23	.1	1.5	.2	2.6
49	IIIA2b	175-190	8.1	.3	.029	6.0	5	128	.12	.2	3.0	1.1	1.8
50	IIIB2tb	190-235	8.0	.2	.017	6.8	4	163	.13	.1	3.6	.7	1.5
51	IIIC1cab	235-262	8.1	.2	.020	5.8	7	151	.12	.3	2.4	.5	1.7
52	IIIC2b	262-290	8.1	.2	.020	5.8	8	147	.12	.1	4.0	.6	1.8
x	IVC2b	290-325											

Site No. 8

Appendix Table A-5. (continued)

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/l)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
53	A11	0-13	.6	4.0	1.2	.3	1.9	0	6.1	.3	.4	.04	.2	20.4	12.9	1.8	.1	1.1	.5	<1	1.0
54	A12	13-36	.3	1.8	.6	.2	.8	0	2.3	.2	.2	.04	.2	25.0	13.8	2.1	.1	1.2	.4	<1	1.6
55	B21t	36-66	.3	1.7	.6	.3	.5	0	2.5	0	.4	.02	.3	25.5	13.3	2.7	.1	1.1	.4	<1	1.6
56	B22t	66-99	.2	1.2	.4	.2	.2	0	1.5	0	.4	.09	.3	23.6	15.4	3.2	.1	.7	.4	<1	2.0
57	C	99-117	.3	1.6	.5	.3	.1	0	1.8	0	.4	.13	.5	20.5	13.6	2.9	.1	.3	.5	<1	1.4
58	CR	117-152	.3	1.8	.7	.4	.05	0	2.1	.6	.6	.15	.4	14.1	x	x	.15	.4	2.8	<1	18.7

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
53	A11	0-13	6.5	4.9	.269	10.6	38	462	.26	2.7	36.0	.8	11.4
54	A12	13-36	6.2	3.4	.253	7.8	27	472	.22	2.1	36.8	1.0	22.0
55	B21t	36-66	6.2	1.8	.139	7.5	28	415	.10	.2	26.8	1.2	20.0
56	B22t	66-99	6.4	1.2	.092	7.6	5	291	.26	.2	20.8	.7	26.5
57	C	99-117	7.0	.9	.064	8.2	5	126	.33	.1	12.7	.5	6.3
58	CR	117-152	8.2	.5	.038	7.7	1	58	.19	.3	3.8	.4	.7

Appendix Table A-5. (continued)

Site No. 9

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
59	A1	0-8	.9	5.2	2.2	.2	1.9	0	8.3	.4	.4	.05	.1	34.2	25.9	4.1	.4	1.4	1.2	<1	2.0
60	B21t	8-18	.5	3.2	1.3	.2	.6	0	4.6	0	.4	.03	.1	26.0	19.6	3.2	.3	1.0	1.2	<1	1.0
61	B22t	18-28	.4	2.9	.8	.2	.3	0	3.2	0	.4	.02	.2	28.4	20.9	3.4	.3	.9	1.1	<1	1.8
62	B23t	28-66	.4	2.8	.7	.3	.1	0	3.0	0	.4	.01	.2	30.9	24.8	4.2	.4	.5	1.3	<1	2.6
63	B3	66-87	.3	2.5	.7	.3	.1	0	2.7	0	.7	.01	.3	25.8	x	x	.5	.3	1.9	<1	10.6
64	C	87-128	.4	2.7	.9	.4	.1	0	3.2	0	.6	.01	.3	26.3	x	x	.6	.2	2.3	<1	11.6
65	CR	128-158	.3	1.6	.9	.3	.05	0	2.0	.1	.3	.08	.3	24.6	x	x	.4	.2?	1.6	<1	14.9

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
59	A1	0-8	7.1	10.8	.477	13.2	12	574	.56	2.6	15.3	.9	4.6
60	B21t	8-18	7.3	4.2	.195	12.5	3	401	.20	.9	11.2	.8	13.3
61	B22t	18-28	7.2	3.0	.151	11.6	4	344	.26	.4	10.1	.7	13.0
62	B23t	28-66	7.7	2.3	.109	12.3	5	206	.29	.2	6.7	.7	7.0
63	B3	66-87	7.7	1.3	.081	9.3	4	108	.26	.2	4.9	.5	3.6
64	C	87-128	7.9	1.4	.087	9.4	12	84	.18	.4	3.1	.5	3.0
65	CR	128-158	7.9	1.3	.073	10.4	1	88	.13	.9	4.6	.6	1.9

Appendix Table A-5. (continued)

Site No. 10

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
66	A11	0-18	.3	2.0	.6	.2	.3	0	2.8	.2	.4	.03	.1	17.6	12.3	1.7	.1	.4	.6	<1	1.2
67	A12	18-36	.2	1.5	.5	.2	.2	0	1.5	.1	.7	.03	.2	13.4	9.2	1.6	.1	.4	.7	<1	.8
68	B1	36-68	.3	2.0	.8	.2	.2	0	2.9	.05	.4	.01	.2	8.5	5.7	1.6	.1	.2	1.2	<1	2.0
69	B21t	68-120	.2	1.2	.6	.6	.1	0	1.2	.4	.4	.02	.6	15.5	10.0	3.0	.2	.2	1.3	<1	1.2
70	B22t	120-158	.3	1.5	.7	.7	.1	0	1.3	1.5	.4	.03	.6	15.3	9.6	2.8	.2	.2	1.3	<1	1.2
71	B3	158-190	.3	1.9	.7	.6	.1	0	1.5	1.5	.5	.04	.5	12.4	8.2	2.1	.2	.1	1.6	<1	1.0
72	CR	190-219	.2	.9	.3	.4	.05	0	.3	1.2	.3	.05	.5	9.2	6.3	1.8	.2	.08	2.2	<1	.5

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
66	A11	0-18	6.8	2.5	.130	11.2	6	166	.42	.3	33.4	.2	4.6
67	A12	18-36	6.9	1.5	.091	9.6	5	147	.33	.1	26.2	.2	2.6
68	B1	36-68	7.0	.5	.037	7.9	7	97	.50	.2	21.1	.1	1.7
69	B21t	68-120	6.3	.5	.035	8.3	8	80	.42	.2	21.1	.1	1.6
70	B22t	120-158	6.4	.5	.030	9.7	2	60	.43	.2	12.9	.1	3.7
71	B3	158-190	7.0	.5	.026	11.2	2	57	.21	.1	10.1	.1	3.7
72	CR	190-219	7.7	.3	.022	7.9	1	30	.30	.4	5.5	.04	2.5

Appendix Table A-5. (continued)

Site No. 11

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
73	A2	0-13	1.0	2.6	1.1	4.4	2.0	0	5.3	1.5	.9	2.5	3.2	7.2	5.2	.4	.4	1.1	5.6	1	1.2
74	B2t	13-28	3.9	.9	.1	45.8	.8	2.2	14.7	15.1	20.8	.13	64.8	19.8	x	x	13.8	3.2	69.7	1	9.6
75	B3ca	28-46	9.9	.4	.2	104.7	1.6	11.3	11.8	40.5	45.0	.4	190.2	17.0	x	x	14.1	2.1	77.1	<1	1.2
76	C1	46-64	11.2	.4	.3	133.8	1.5	11.3	6.0	67.7	55.0	.2	226.2	9.5	x	x	7.4	1.1	77.9	<1	5.0
77	IIC2	64-152	16.5	.4	.2	190.4	2.2	10.3	5.1	100.2	80.5	.2	347.6	10.5	x	x	7.6	1.2	72.4	<1	13.4

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
73	A2	0-13	7.4	.8	.070	6.7	7	480	.48	.4	3.2	.3	7.9
74	B2t	13-28	9.2	.6	.044	7.9	12	1250	1.23	.2	3.9	.6	4.5
75	B3ca	28-46	9.9	.3	.022	7.9	17	850	2.59	.5	4.5	1.0	2.4
76	C1	46-64	10.0	.2	.010	11.6	12	418	1.79	.3	4.8	.6	1.4
77	IIC2	64-152	10.0	.2	.010	11.6	10	425	1.35	.2	2.1	.4	.8

Appendix Table A-5. (continued)

Site No. 13

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/l)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
78	A1	0-12	.8	4.1	2.5	.6	1.5	0	8.1	.3	.7	.1	.3	12.3	10.3	2.4	.1	.8	.8	< 1	2.2
79	B21t	12-25	.5	2.8	1.6	1.0	.4	0	4.8	< .1	.4	.1	.7	19.4	13.6	5.3	.2	1.2	1.0	< 1	2.0
80	B22t	25-40	.3	1.7	1.3	.5	.1	0	3.4	< .1	.2	< .1	.4	18.2	x	x	.2	.4	1.1	< 1	24.6
81	B3ca	40-71	.4	1.2	1.9	.7	.2	0	3.8	< .1	.2	.1	.6	14.3	x	x	.3	.3	2.1	< 1	17.2
82	Cca	71-112	.9	.4	5.1	3.7	.5	0	5.6	3.4	1.2	.2	2.2	11.2	x	x	.4	.4	3.6	< 1	13.8
83	C	112-165	5.5	1.7	43.9	25.4	1.8	0	4.4	62.0	7.2	.3	5.3	12.9	x	x	.7	.5	5.4	1.9	11.0

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
78	A1	0-12	7.7	2.3	.144	9.3	10	336	.65	.9	4.8	.4	3.2
79	B21t	12-25	7.7	1.1	.099	6.5	2	473	.64	.2	5.0	.7	6.6
80	B22t	25-40	8.2	.9	.084	6.2	1	165	.32	.2	4.4	.4	2.9
81	B3ca	40-71	8.4	.8	.071	6.6	1	123	.17	.2	4.5	.4	1.8
82	Cca	71-112	8.7	.6	.054	6.5	10	178	.28	.2	4.8	.5	1.2
83	C	112-165	8.6	.6	.058	6.0	10	245	.74	.3	6.6	.6	1.4

Appendix Table A-5. (continued)

Site No. 13

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
84	A1	0-13	.9	4.5	1.8	.6	2.3	0	6.1	1.6	.4	.2	.3	22.6	14.4	2.1	.1	1.9	.4	<1	1.2
85	B2	13-31	.4	2.1	.6	.7	.6	0	3.2	.1	.5	.1	.6	20.3	13.9	1.8	.2	.9	1.0	<1	1.2
86	B21	31-45	.4	2.8	.9	.5	.2	0	3.6	<.1	.6	<.1	.4	19.2	1.3	2.0	.2	.5	1.0	<1	1.2
87	B22	45-74	.4	2.9	1.0	.8	.05	0	3.1	1.4	.6	.1	.6	25.2	20.4	4.1	.2	.2	.8	<1	1.6
88	R	74-100	.5	4.2	1.4	.8	.06	0	5.1	.2	.6	.1	.5	38.5	29.5	5.7	.3	.3	.8	<1	1.8

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
84	A1	0-13	6.6	4.2	.254	9.6	18	880	.59	1.1	43.4	.9	23.6
85	B2	13-31	6.7	2.8	.200	8.1	4	358	.34	.2	31.1	.6	15.1
86	B21	31-45	6.7	1.7	.141	7.0	2	210	.57	.3	24.8	.3	9.8
87	B22	45-74	7.8	1.2	.116	6.0	1	120	.48	.2	15.0	.1	7.6
88	R	74-100	7.2	1.4	.126	6.5	3	135	.64	1.0	18.1	1.0	8.5

Appendix Table A-5. (continued)

Site No. 14

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
89	A11	0-36	.4	1.6	.5	.4	1.1	0	3.3	.1	.4	.1	.8	29.7	19.5	3.9	.2	2.3	1.0	<1	1.2
90	A12	36-104	.4	1.9	.5	.7	.6	0	3.0	<.1	.2	.1	.6	31.2	23.7	3.7	.2	1.6	.9	<1	1.0
91	C	104-162	.3	1.6	.4	.5	.5	0	2.9	<.1	.2	<.1	.5	27.8	21.2	3.4	.2	1.5	.9	<1	1.4
92	A1b	162-184	.3	1.6	.4	.6	.4	0	2.8	<.1	.2	.1	.6	29.3	22.3	3.5	.3	1.3	1.4	<1	1.8

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
89	A11	0-36	6.6	4.3	.258	9.7	52	1000	.32	2.8	43.0	.9	16.9
90	A12	36-104	7.0	3.3	.207	9.3	28	700	.49	.8	19.6	.7	14.0
91	C	104-162	7.3	3.0	.200	8.7	32	650	.29	.3	15.9	.6	9.6
92	A1b	162-184	7.5	2.4	.157	8.9	39	630	.50	.5	17.9	.8	7.5

Appendix Table A-5. (continued)

Site No. 15

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/l)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
93	A11	0-20	.4	2.9	1.2	.5	.3	0	3.8	.1	.5	.1	.4	26.3	19.2	4.6	.2	.7	.8	< 1	1.4
94	A12	20-38	.4	2.2	1.0	.9	.05	0	3.0	< .1	.5	< .1	.7	26.3	19.7	4.6	.2	.2	.8	< 1	1.6
95	A13	38-71	.3	1.8	.8	.6	.04	0	2.8	< .1	.3	< .1	.5	25.6	18.8	4.3	.2	.2	.8	< 1	1.6
96	C1	71-132	.4	.9	1.3	1.4	.03	0	2.5	.4	.7	< .1	1.3	23.5	17.6	4.5	.4	.1	1.7	< 1	1.8
x	R	> 132																			

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
93	A11	0-20	6.5	3.8	.226	9.8	13	295	.81	.6	34.0	1.0	12.0
94	A12	20-38	6.6	3.0	.209	8.3	9	93	.50	.3	24.8	.6	9.0
95	A13	38-71	6.8	1.7	.152	6.5	8	78	.29	.1	18.3	.4	6.9
96	C1	71-132	7.3	.6	.055	6.3	3	43	.37	1.9	5.6	.3	4.0
x	R	> 132											

Appendix Table A-5. (continued)

Site No. 16

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/l)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
97	A1	0-15	.4	2.6	.8	.6	.05	0	3.8	<.1	.2	<.1	.5	26.3	21.1	3.9	.2	.3	.8	<1	1.8
98	B2	15-44	.5	3.8	.9	1.2	.04	0	5.2	.1	.4	.1	.8	30.0	25.7	4.0	.4	.2	1.3	<1	1.8
x	R	>44																			

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
97	A1	0-15	6.9	2.8	.175	9.3	5	108	.61	.5	11.7	.5	3.7
98	B2	15-44	7.6	1.7	.137	7.2	1	85	.26	1.0	7.3	.3	2.9
x	R	>44											

Appendix Table A-5. (continued)

Site No. 17

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
99	A11	0-15	.3	2.4	.8	.4	.1	0	3.2	<.1	.3	.1	.3	17.1	25.5	4.7	.2	.5	.5	<1	1.0
100	A12	15-64	.3	1.8	.5	.4	.1	0	2.4	<.1	.1	<.1	.4	14.7	24.6	4.3	.2	.3	.6	<1	2.0
101	B2t	64-126	.2	1.6	.5	.4	.04	0	2.2	<.1	.1	<.1	.4	36.3	25.0	6.1	.4	.2	1.1	<1	1.6
x	R	>126																			

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
99	A11	0-15	6.5	5.4	.313	10.0	14	215	.62	.4	71.4	.7	13.1
100	A12	15-64	6.3	3.5	.256	8.0	6	125	.42	.2	57.4	.5	12.1
101	B2t	64-126	6.7	2.5	.180	8.1	3	95	.36	.2	18.7	1.4	8.4
x	R	>126											

Appendix Table A-5. (continued)

Site No. 18

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/l)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
102	A1	0-13	.4	2.9	1.1	.4	.1	0	4.2	< .1	.1	< .1	.3	24.9	19.0	5.0	.2	.3	.8	< 1	1.6
103	B2t	13-28	.4	3.2	1.3	.5	.1	0	5.0	< .1	.1	< .1	.3	24.9	x	x	.3	.2	1.2	< 1	6.4
104	B3ca	28-61	.3	1.9	1.0	.7	.1	0	3.2	< .1	.1	.1	.6	21.4	x	x	.4	.2	1.9	< 1	15.4
105	Cca	61-99	.6	.4	.5	5.6	.05	0	5.0	1.2	.2	.3	8.3	20.0	x	x	2.6	.2	13.0	< 1	17.6
106	B21 tcab	99-144	1.5	.3	.6	15.5	.05	0	8.4	7.8	.4	.1	23.1	23.5	x	x	6.8	.2	28.9	< 1	14.8
107	B22 tcab	144-190	7.1	3.7	16.4	59.2	.1	0	3.9	63.8	11.5	< .1	18.7	24.9	x	x	6.1	.3	24.5	< 1	11.8
108	B23 tcab	190-206	11.2	12.6	46.2	88.9	.2	0	3.2	125.0	20.0	.1	16.4	22.6	x	x	5.8	.3	25.7	< 1	6.2
109	Ccsb	> 206	13.0	24.2	58.7	103.7	.2	0	2.8	164.1	20.0	< .1	16.1	22.9	x	x	5.1	.3	22.3	< 1	6.2

x R

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
102	A1	0-13	7.2	1.5	.128	6.8	6	135	.71	.2	5.9	.6	5.4
103	B2t	13-28	7.9	1.4	.126	6.5	1	95	.42	.2	4.7	.5	4.7
104	B3ca	28-61	8.0	.9	.080	6.5	1	93	.36	.1	4.6	.3	2.9
105	Cca	61-99	8.4	.5	.046	6.3	1	78	.44	.1	3.3	.3	2.3
106	B21 tcab	99-144	8.6	.4	.042	5.5	3	93	.86	.1	2.3	.4	1.4
107	B22 tcab	144-190	8.5	.3	.027	6.5	11	127	2.07	.1	3.6	.4	1.3
108	B23 tcab	190-206	8.4	.3	.033	5.3	16	133	1.01	.1	3.1	.9	1.7
109	Ccsb	> 206	8.2	.3	.034	5.1	17	125	.93	.1	3.6	.7	1.7

x R

Appendix Table A-5. (continued)

Site No. 19

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
110	A1	0-10	.5	3.7	.8	.3	.2	0	4.4	.2	.4	.02	.2	28.8	23.9	2.7	.4	.6	1.4	<1	1.8
111	AC	10-27	.5	4.2	.8	.4	.1	0	4.8	.05	.4	.02	.3	30.9	x	x	.6	.3	1.9	<1	13.4
112	Cr	27-40	.4	3.4	.6	.5	.1	0	4.5	.1	.4	.01	.4	28.3	x	x	.6	.1	2.1	<1	44.8
113	R	> 40	.4	3.0	.5	.5	0	0	3.4	< .1	.3	.02	.4	15.5	x	x	.4	.08	2.6	<1	52.1

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
110	A1	0-10	7.6	3.4	.186	10.6	7	239	.61	.3	13.3	.4	6.0
111	AC	10-27	8.0	2.5	.176	8.3	4	110	.82	.1	9.2	.4	3.8
112	Cr	27-40	8.2	1.8	.153	6.8	4	41	.56	.1	2.8	.5	4.0
113	R	> 40	8.2	1.3	.081	9.3	1	30	.46	2.4	4.3	.3	3.3

Appendix Table A-5. (continued)

Site No. 20

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
115	A1	0-15	.5	4.4	.6	.8	.2	0	4.4	1.5	.1	<.1	.5	10.9	x	x	.3	.2	2.8	<1	5.8
116	C1	15-41	.6	4.8	.9	1.4	.1	0	3.8	3.5	.1	.1	.8	11.2	x	x	.3	.1	2.7	<1	5.4
117	C2	41-54	.5	3.3	.8	1.8	.1	0	5.1	.4	.2	.1	1.3	11.6	x	x	.4	.1	3.5	<1	6.4
118	C3	54-94	.9	1.5	.2	7.3	.1	0	8.0	1.0	.4	.1	7.9	11.6	x	x	1.8	.1	15.5	<1	5.8
119	A1b	94-107	1.1	2.3	.2	10.8	.1	0	8.4	3.5	1.6	.2	9.7	11.4	x	x	2.4	.2	21.1	<1	5.2
120	IIC1	107-127	1.5	2.5	.4	14.4	.2	0	7.6	5.5	4.3	.01	12.0	11.2	x	x	1.3	.2	11.6	<1	6.0
121	IIC2	127-153	2.9	5.2	.9	25.5	.2	0	4.8	17.7	7.0	3.0	14.6	10.2	x	x	2.1	.2	20.6	<1	6.2
122	IIIC1	153-180	2.4	8.1	1.4	18.6	.2	0	7.5	8.8	8.4	6.0	8.5	10.5	x	x	.9	.2	8.6	<1	5.6

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
115	A1	0-15	8.2	.8	.057	8.2	2	93	.52	.2	2.9	.1	1.5
116	C1	15-41	8.3	.6	.047	7.4	1	55	.66	.1	2.5	.1	1.5
117	C2	41-54	8.3	.7	.061	6.7	1	55	.68	.2	2.3	.2	1.5
118	C3	54-94	8.6	.6	.058	6.0	1	53	.42	.2	1.7	.2	1.9
119	A1b	94-107	8.5	.8	.075	6.2	5	78	.56	.1	3.0	.2	2.2
120	IIC1	107-127	8.2	.7	.056	7.3	4	67	.48	.8	6.2	.3	3.1
121	IIC2	127-153	8.6	.4	.034	6.8	3	70	.63	.3	3.0	.2	2.1
122	IIIC1	153-180	8.4	.3	.030	5.8	4	73	.62	.2	2.6	.2	1.8

Appendix Table A-5. (continued)

Site No. 21

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
123	A1	0-30	.9	3.4	.4	7.6	.2	0	8.2	2.1	1.4	.2	5.5	18.3	x	x	1.4	.1	7.7	<1	9.4
124	A1b	30-46	.7	4.5	.5	3.2	.4	0	5.6	.4	1.3	.1	2.0	18.3	x	x	.5	.6	2.7	<1	8.4
125	IIIC1	46-99	2.7	2.3	.4	24.6	.4	0	8.9	3.3	14.4	.1	21.2	17.3	x	x	4.7	.8	27.2	<1	10.0
126	IIIA1b	99-110	5.5	10.6	1.3	61.6	.2	0	13.5	30.7	25.5	.8	25.9	22.3	x	x	7.6	.3	34.1	1.2	8.6
127	IIIC1	110-143	11.0	10.9	2.7	100.6	.6	0	10.5	37.0	62.9	.4	38.6	13.3	x	x	5.3	.4	39.9	<1	8.4
128	IIIC2	143-160	8.5	27.5	13.1	57.7	.6	0	3.9	16.0	83.0	.1	17.8	10.6	x	x	1.6	.3	15.1	<1	5.2
129	IVA1b	160-180	14.1	40.8	16.0	87.1	1.2	0	3.1	15.6	131.2	.1	16.3	17.5	x	x	2.3	.9	13.1	<1	8.6
130	IVC1	180-198	14.5	35.7	15.6	94.6	1.5	0	2.8	20.8	123.5	.1	18.7	15.7	x	x	2.0	.9	12.7	<1	9.2

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
123	A1	0-30	8.4	2.5	.159	9.1	11	135	.65	.2	7.1	.4	3.5
124	A1b	30-46	8.1	2.7	.179	8.8	11	225	.84	.4	5.3	.4	3.4
125	IIIC1	46-99	8.5	1.3	.099	7.6	5	295	1.00	.2	3.9	.5	3.2
126	IIIA1b	99-110	8.6	2.5	.171	8.5	8	110	1.10	.4	9.2	.5	10.8
127	IIIC1	110-143	8.5	.9	.084	6.2	10	153	1.15	.3	4.5	.4	3.3
128	IIIC2	143-160	8.0	.6	.055	6.3	7	113	.33	.2	2.0	.3	1.7
129	IVA1b	160-180	7.9	1.4	.093	8.8	6	350	.74	.4	3.0	.3	2.7
130	IVC1	180-198	8.0	1.2	.089	7.8	7	398	.74	.3	1.6	.3	2.2

Appendix Table A-5. (continued)

Site No. 22

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
131	A2	0-8	.7	2.0	1.7	3.9	1.5	0	7.4	.1	.6	<.1	2.9	10.3	6.4	3.2	.3	.3	2.9	<1	.8
132	B2t	8-21	.8	.5	.6	7.5	.3	0	6.5	<.1	1.8	<.1	10.1	32.2	17.7	12.3	4.0	.4	12.4	<1	2.2
133	B3ca	21-41	1.6	1.2	1.2	14.1	.06	0	6.0	1.1	8.3	.1	12.9	20.6	x	x	3.6	.3	17.5	<1	7.6
134	C1ca	41-82	4.9	2.1	5.1	47.0	.1	0	3.7	13.5	32.7	.1	24.8	18.0	x	x	3.6	.2	20.0	<1	20.0
135	C2	82-152	12.4	18.6	34.3	98.0	.2	0	2.2	91.1	50.1	.1	19.1	17.5	x	x	3.5	.3	20.0	6.7	8.6
136	II C1ca	152-200	12.7	23.4	34.9	100.9	.2	0	2.1	104.2	42.1	.1	18.7	18.8	x	x	4.9	.3	26.1	10.3	6.0

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
131	A2	0-8	7.6	1.1	.080	8.0	2	140	.33	.5	6.2	.6	7.0
132	B2t	8-21	7.8	.9	.071	7.4	1	140	.10	.1	8.1	.8	5.5
133	B3ca	21-41	8.2	.9	.075	7.0	3	128	.07	.2	7.8	.8	4.5
134	C1ca	41-82	8.4	.7	.056	7.3	5	95	1.05	.1	5.8	.4	4.6
135	C2	82-152	8.4	.3	.022	7.9	11	133	2.40	.3	7.1	.6	3.0
136	II C1ca	152-200	8.4	.2	.020	5.8	12	108	1.40	.1	4.6	.5	1.9

Appendix Table A-5. (continued)

Site No. 23

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/l)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCo_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
137	A1	0-10	.7	4.2	2.5	1.0	.2	0	6.9	.1	.2	<.1	.6	17.2	13.5	5.1	.2	.5	1.2	<1	1.4
138	B2	10-26	.5	2.4	1.4	1.9	.07	0	5.0	<.1	.2	<.1	1.4	24.7	18.5	7.2	.3	.3	1.2	<1	1.6
139	B3ca	26-39	.6	1.9	1.7	3.0	.07	0	5.2	<.1	.3	<.1	2.4	22.4	x	x	.7	.3	3.1	<1	5.4
140	Cca	39-92	.8	.3	.4	8.1	.06	0	6.1	.1	1.5	.3	13.7	17.0	x	x	2.3	.2	13.5	<1	19.4
141	C	92-143	10.2	4.2	18.1	86.2	.2	0	3.6	48.2	50.1	.1	25.8	18.3	x	x	4.7	.3	25.7	<1	7.4
142	IICca	143-200	12.7	21.0	34.9	91.3	.2	0	2.4	101.6	39.7	.1	17.3	19.7	x	x	5.1	.4	25.9	2.3	6.6

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
137	A1	0-10	7.8	1.3	.090	8.4	5	195	.03	.2	6.3	.5	6.6
138	B2	10-26	7.6	1.1	.085	7.5	3	108	.03	.1	5.0	.7	5.8
139	B3ca	26-39	8.0	1.0	.080	7.3	1	120	.44	.1	5.0	.7	4.4
140	Cca	39-92	8.6	.6	.045	7.8	2	85	.48	.1	5.8	.2	2.7
141	C	92-143	8.6	.3	.029	6.0	17	125	2.22	.1	6.1	.5	2.5
142	IICca	143-200	8.4	.3	.022	7.9	16	143	1.15	.1	6.7	.5	1.7

Appendix Table A-5. (continued)

Site No. 24

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
143	Ap	0-13	1.5	6.0	4.3	5.0	.8	0	11.0	1.0	2.8	.8	2.2	27.2	x	x	.6	2.0	2.2	<1	20.8
144	A11	13-37	1.7	6.6	5.9	6.5	.9	0	6.8	12.0	2.3	.1	2.6	28.8	x	x	1.0	2.2	3.5	<1	21.6
145	A12	37-69	5.4	25.8	23.4	24.0	1.1	0	4.6	62.5	1.4	.1	4.8	28.8	x	x	1.5	1.5	5.2	32.7	20.0
146	C1	69-80	3.0	6.5	10.0	21.3	.4	0	6.2	30.8	1.0	.3	7.4	13.7	x	x	1.7	.5	12.4	1.5	10.8
147	C2	80-104	1.6	1.7	3.0	13.0	.2	0	6.9	9.4	1.0	.1	8.5	28.0	x	x	2.9	.9	10.4	<1	17.0
148	A1b	104-122	1.4	1.6	3.0	10.0	.1	0	6.1	6.7	.8	.6	6.6	28.8	x	x	2.1	.4	8.0	<1	17.2
149	IIC1g	122-158	1.3	2.1	3.3	7.9	.1	0	4.5	7.3	.9	.8	4.8	14.8	x	x	1.0	.3	6.8	<1	14.4
150	IIC2g	158-204	1.2	3.0	4.1	6.5	.2	0	4.9	6.3	1.1	1.1	3.5	14.4	x	x	.8	.4	5.6	<1	8.8

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
143	Ap	0-13	7.9	4.9	.290	9.8	38	780	.34	.9	15.5	1.4	8.8
144	A11	13-37	8.1	4.5	.265	9.9	20	850	<.01	.8	22.6	1.6	8.9
145	A12	37-69	8.1	3.1	.249	7.2	5	640	.10	.5	19.7	1.5	7.1
146	C1	69-80	8.5	1.3	.107	7.1	4	205	<.01	.3	22.9	.8	2.2
147	C2	80-104	8.6	2.3	.196	6.8	2	336	<.01	.4	27.6	2.3	2.5
148	A1b	104-122	8.5	2.2	.187	6.8	5	165	.83	.7	39.3	2.0	4.9
149	IIC1g	122-158	8.4	.6	.049	7.1	5	113	.29	.3	24.9	1.3	2.8
150	IIC2g	158-204	8.3	.7	.068	6.0	7	140	.34	.3	25.4	1.6	3.6

Appendix Table A-5. (continued)

Site No. 25

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
151	A1	0-13	.4	4.2	.3	.6	.1	0	4.2	.5	.7	.01	.4	26.8	x	x	.6	.3	2.2	<1	15.8
152	C1	13-23	.4	3.7	.3	.8	.1	0	4.1	0	.7	.01	.6	21.0	x	x	.6	.1	2.9	<1	28.8
153	Cr	23-41	.4	2.8	.4	1.1	.1	0	3.4	0	.7	.53	.9	18.5	x	x	.8	.1	4.3	<1	28.0
154	R	>41	.4	1.2	.4	3.3	.01	0	3.4	<.1	.6	.28	4.2	19.5	x	x	1.7	.03	8.7	<1	22.7

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
151	A1	0-13	8.1	3.9	.198	11.5	8	103	.46	.3	3.9	.3	2.2
152	C1	13-23	8.2	2.6	.118	12.8	3	25	.39	.2	2.6	.3	1.8
153	Cr	23-41	8.3	1.3	.064	11.8	1	18	.61	.2	1.3	.2	1.3
154	R	>41	8.8	1.1	.049	13.1	1	13	.61	.6	1.4	.1	.7

Appendix Table A-5. (continued)

Site No. 26

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/l)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
155	A1	0-11	.7	5.2	1.7	.6	.2	0	6.5	<.1	.3	.1	.3	22.4	21.3	4.1	.1	.5	.5	<1	1.8
156	B2	11-30	.6	3.5	1.1	1.5	.06	0	5.7	<.1	.4	<.1	1.0	21.2	x	x	.3	.2	1.4	<1	4.0
157	C1	30-56	.8	2.0	1.0	5.7	.1	0	7.9	<.1	.4	<.1	4.7	21.2	x	x	1.4	.2	6.6	<1	4.6
x	R	>56																			

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
155	A1	0-11	7.6	2.0	.134	8.7	12	178	.90	.3	3.4	.4	3.6
156	B2	11-30	8.0	1.3	.089	8.5	2	73	.30	.2	1.6	.3	2.3
157	C1	30-56	8.0	1.3	.088	8.6	1	65	.13	.1	1.5	.3	3.9
x	R	>56											

Appendix Table A-5. (continued)

Site No. 27

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
159	A1	0-8	.7	4.0	2.3	.2	.8	0	5.7	.05	.7	.04	.1	26.3	16.3	4.6	.3	1.6	1.1	< 1	1.4
160	B21	8-15	.6	3.6	2.4	.2	.4	0	5.3	0	.4	.02	.1	30.0	17.4	7.2	.3	1.7	1.0	< 1	1.0
161	B22	15-46	.4	1.8	1.6	.6	.1	0	3.2	0	.4	.01	.5	30.9	x	x	.6	.5	1.9	< 1	6.2
162	B3	46-71	.3	.9	1.4	1.7	.1	0	3.4	0	.4	<.01	1.7	29.3	x	x	.9	.4	3.1	< 1	9.6
163	C	71-81	.4	.5	1.2	2.5	.1	0	3.6	0	.4	.02	2.8	27.3	x	x	1.4	.3	5.1	< 1	17.2
164	CR	>81	1.9	1.6	6.1	13.0	.09	0	2.6	13.3	3.7	.05	6.8	25.6	x	x	2.0	.2	7.8	< 1	21.0

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
159	A1	0-8	6.5	6.4	.476	7.8	28	612	.35	2.6	29.1	1.1	11.2
160	B21	8-15	7.0	2.9	.254	6.6	12	656	.01	.6	14.1	.9	11.2
161	B22	15-46	8.0	1.4	.118	6.9	4	213	.47	.2	6.4	.5	5.6
162	B3	46-71	8.2	1.3	.082	9.2	7	154	.39	.3	5.7	.5	4.2
163	C	71-81	8.3	1.0	.074	7.9	16	107	.49	.3	4.2	.6	3.2
164	CR	>81	8.5	.8	.065	7.2	4	78	.82	.5	2.4	.9	2.0

Appendix Table A-5. (continued)

Site No. 28

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
165	A11	0-36	.4	2.3	.6	.2	1.5	0	3.6	.2	.2	<.1	.2	24.4	18.9	2.1	.1	.9	.4	<1	.8
166	A12	36-66	.3	1.7	.6	.2	.5	0	2.5	<.1	.2	<.1	.2	17.3	12.4	1.9	<.1	.6	0	<1	1.0
167	A2b	66-77	.2	1.3	.5	.2	.4	0	1.8	<.1	.5	.3	.2	16.8	12.0	1.9	<.1	.4	0	<1	.4
168	B&Ab	77-118	.2	1.2	.5	.3	.2	0	1.5	<.1	.1	.4	.3	18.9	12.5	3.6	<.1	.4	0	<1	1.0
169	B21tb	118-178	.2	.8	.5	.4	.07	0	1.2	<.1	.2	.4	.5	24.4	15.0	6.1	.1	.3	.4	<1	.8
170	B22tb	178-234	.5	2.5	1.7	1.1	.1	0	4.8	<.1	.2	.5	.8	20.3	16.4	6.3	.2	.3	1.0	<1	1.6
171	C	234-254	.4	1.5	1.2	1.2	.1	0	3.0	<.1	.6	.5	1.0	15.8	x	x	.3	.3	1.9	<1	6.8
x	R	>254																			

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
165	A11	0-36	6.5	6.4	.391	9.5	11	405	.65	3.0	50.0	.5	16.7
166	A12	36-66	6.7	2.9	.185	9.1	4	220	.56	.2	31.4	.4	7.8
167	A2b	66-77	6.7	.9	.067	7.8	1	165	.16	.1	17.5	.2	2.8
168	B&Ab	77-118	6.7	.6	.044	7.9	3	145	.03	.1	19.3	.4	3.0
169	B21tb	118-178	6.8	.4	.031	7.5	4	115	.10	.1	16.8	.9	4.5
170	B22tb	178-234	8.2	.4	.030	7.8	1	108	.18	.2	4.7	.9	2.7
171	C	234-254	8.0	.3	.027	6.5	1	100	.05	.2	3.7	.6	1.0
x	R	>254											

Appendix Table A-5. (continued)

Site No. 29

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
172	A11	0-13	.5	2.5	.7	.2	2.0	0	3.5	.2	.6	.1	.2	25.0	16.4	2.2	.1	1.6	.4	<1	.8
173	A12	13-47	.3	2.0	.4	.2	.7	0	2.4	.3	.1	.1	.2	22.4	14.9	1.5	.1	.8	.5	<1	.8
174	A13	47-89	.3	1.8	.4	.2	.5	0	2.2	.1	.1	<.1	.2	18.2	12.6	1.6	.1	.6	.6	<1	.4
175	B	89-127	.3	1.7	.6	.3	.4	0	2.6	.1	.1	<.1	.3	17.1	10.6	2.0	.1	.5	.6	<1	.2
x	Cr	>127																			

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
172	A11	0-13	6.3	6.5	.382	9.9	34	630	.44	.6	64.1	.5	20.0
173	A12	13-47	6.5	4.4	.277	9.2	13	308	.49	.3	45.6	.4	15.3
174	A13	47-89	6.6	3.0	.180	9.7	6	238	.32	.2	32.2	.4	14.8
175	B	89-127	6.6	2.3	.153	8.7	5	210	.40	.1	28.0	.4	12.1
x	Cr	>127											

Appendix Table A-5. (continued)

Site No. 30

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
176	A1	0-8	.9	6.6	2.4	.5	.9	0	4.2	5.0	.8	<.1	.2	33.5	25.4	6.6	.2	2.1	.6	< 1	2.0
177	B21	8-26	.5	2.3	1.3	1.5	.2	0	4.3	.1	.1	.1	1.1	33.5	x	x	.5	.7	1.5	< 1	3.2
178	B22	26-89	.9	.8	1.2	7.9	.1	0	4.5	4.8	.9	.2	7.9	32.7	x	x	2.8	.7	8.6	3.1	7.0
179	B3 cacs	89-122	7.7	24.9	49.8	45.3	.7	0	2.1	110.7	6.1	.4	7.4	26.8	x	x	3.6	.4	13.4	25.2	7.8
x	Cr	122-148																			

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
176	A1	0-8	7.8	2.5	.175	8.3	21	800	.25	.4	5.2	1.0	15.1
177	B21	8-26	7.9	1.2	.098	7.1	1	368	.33	.1	5.1	1.0	3.7
178	B22	26-89	8.4	.8	.065	7.2	1	283	.53	.1	6.5	1.0	3.9
179	B3 cacs	89-122	8.1	.4	.040	5.8	3	175	2.07	.1	4.3	.6	.5
x	Cr	122-148											

Appendix Table A-5. (continued)

Site No. 31

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
180	A2	0-5	1.3	2.2	3.2	7.9	1.1	0	6.3	7.6	1.1	.1	4.8	15.2	7.6	5.3	.7	.9	4.6	< 1	.8
181	B21t	5-23	.9	.6	.8	8.1	.2	0	6.8	< .1	1.0	.1	9.7	21.2	8.5	9.3	2.3	.7	10.9	< 1	1.2
182	B22 tsa	23-64	18.8	24.1	176.1	135.1	.7	0	6.1	294.3	13.1	.1	13.5	22.7	x	x	3.4	.5	15.0	21.6	1.8
183	B3sa	64-104	24.2	21.6	234.0	181.1	.9	0	2.8	422.7	14.8	.1	20.6	25.7	x	x	5.8	.6	22.6	17.1	1.6
184	Csacs	104-155	28.2	21.4	265.1	233.1	.9	0	2.4	506.0	15.2	.1	19.5	26.4	x	x	6.2	.6	23.5	15.2	1.4

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
180	A2	0-5	6.8	2.5	.195	7.5	27	358	.23	1.0	23.7	1.8	16.9
181	B21t	5-23	7.0	1.4	.101	8.1	15	278	.01	.5	16.7	1.8	14.1
182	B22 tsa	23-64	8.2	.9	.073	7.2	13	195	.05	.4	11.8	1.9	2.8
183	B3sa	64-104	8.4	.5	.051	5.7	23	245	.25	.6	15.7	2.0	1.2
184	Csacs	104-155	8.5	.5	.044	6.6	17	240	.05	.6	14.4	1.9	1.6

Appendix Table A-5. (continued)

Site No. 32

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCo_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
185			6.2	1.2	19.5	72.8	.3	0	32.3	49.5	4.0	.1	22.6	32.4	x	x	7.0	.6	21.6	4.0	18.6
186			2.2	.6	3.0	25.9	.1	0	9.0	16.1	1.1	.1	19.3	8.4	x	x	2.2	.2	26.2	<1	6.0
187			2.9	.8	5.7	27.3	.2	0	7.7	20.3	1.5	<.1	15.1	22.2	x	x	3.3	.7	14.9	<1	15.0
188			2.1	.5	3.8	18.9	.1	0	6.5	14.0	1.3	<.1	12.9	23.5	x	x	3.9	.5	16.6	<1	9.0
189			2.5	.8	4.7	26.9	.1	0	7.0	18.2	2.4	.1	16.2	12.0	x	x	3.8	.3	31.7	<1	11.4

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
185			8.2	5.2	.234	12.9	17	245	1.24	1.0	70.5	4.8	18.8
186			8.9	.6	.054	6.5	5	63	.38	.3	31.9	1.2	7.9
187			8.7	1.6	.112	8.3	21	273	.46	.8	50.2	2.4	7.7
188			8.7	.9	.080	6.5	18	193	.30	.4	41.2	2.0	10.9
189			8.8	.5	.043	6.8	11	113	.22	.3	49.2	2.0	37.3

Appendix Table A-5. (continued)

Site No. 33

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCo_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
190	A1	0-5	1.0	4.0	4.6	.6	2.2	0	7.5	.7	1.5	.2	.3	18.8	14.2	2.8	.1	1.0	.5	<1	1.0
191	A2	5-10	.6	2.2	3.0	.5	1.1	0	5.2	.1	.8	.1	.3	12.2	8.1	2.5	.1	1.0	.8	<1	.4
192	B&A	10-23	.4	1.0	2.1	1.3	.2	0	3.7	<.1	.5	<.1	1.0	16.6	9.0	6.7	.3	.6	1.8	<1	0
193	B21t	23-39	.3	.4	1.0	2.1	.1	0	2.8	.1	.3	<.1	2.5	32.7	10.5	20.3	1.0	.6	3.1	<1	.8
194	B22t	39-56	.8	.9	3.2	4.4	.1	0	5.2	.1	3.4	<.1	3.1	32.1	16.9	13.0	.2	1.7	.6	<1	1.0
195	B3tca	56-79	3.1	2.6	14.9	27.0	.1	0	3.6	18.2	16.3	<.1	9.1	17.0	x	x	1.5	.3	8.8	3.0	5.6
196	Cca	79-100	8.0	18.4	62.4	38.7	.3	0	2.6	100.3	14.9	<.1	4.1	17.8	x	x	1.4	.3	7.9	2.2	4.0
197	Ccs	100-153	8.2	18.2	70.5	35.6	.4	0	2.8	110.7	13.2	<.1	5.4	19.1	x	x	1.1	.3	5.8	2.9	11.6
198	Cr	153-165	4.1	3.1	24.2	33.3	.3	0	2.8	39.2	17.3	<.1	9.0	22.0	x	x	1.3	.3	5.9	2.4	5.0

Appendix Table A-5. (continued)

Site No. 34

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
190	A1	0-5	6.9	6.8	.260	15.2	20	438	.38	4.9	24.8	1.3	10.0
191	A2	5-10	6.9	2.6	.134	11.3	15	375	.67	1.4	12.0	1.6	10.5
192	B&A	10-23	6.6	1.8	.109	9.6	4	250	.45	.7	12.3	2.2	15.5
193	B21t	23-39	6.9	1.3	.087	8.7	1	245	.81	.3	13.3	3.2	6.7
194	B22t	39-56	8.1	1.0	.079	7.4	2	175	.75	.6	9.7	2.6	1.5
195	B3tca	56-79	8.5	.7	.056	7.3	1	115	.57	.7	8.2	2.7	1.0
196	Cca	79-100	8.3	.7	.059	6.9	2	113	.53	1.0	7.7	3.0	.5
197	Ccs	100-153	8.3	.9	.067	7.8	2	133	.20	2.2	9.3	2.9	.8
198	Cr	153-165	8.3	1.0	.066	8.8	4	125	.16	2.8	8.6	2.7	.4

Site No. 34

Appendix Table A-5. (continued)

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCo_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
199	A1	0-7	.7	4.0	1.8	.2	1.5	0	5.0	.6	.6	.1	.1	24.6	18.9	2.5	.1	1.8	.4	<1	1.2
200	B1	7-20	.5	3.1	1.4	.1	.8	0	3.7	.2	.1	.1	.1	22.3	15.3	1.8	.1	1.2	.5	<1	.2
201	B21t	20-38	.2	1.4	.5	.1	.2	0	1.2	.1	.2	.1	.1	18.6	13.3	2.1	.1	.8	.5	<1	0
202	B22t	38-68	.2	1.4	.5	.2	.1	0	1.5	<.1	.2	.1	.2	23.9	17.4	3.6	.2	.5	.8	<1	1.0
203	B31ca	68-81	.4	3.2	1.4	.3	.1	0	4.0	<.1	.3	<.1	.2	23.6	x	x	.2	.4	.9	<1	6.8
204	B32ca	81-107	.4	2.9	1.8	.3	.1	0	4.2	<.1	.1	<.1	.2	18.0	x	x	.3	.3	1.7	<1	12.0
205	Cca	107-130	.4	1.8	3.2	.4	.1	0	4.7	<.1	.1	<.1	.3	18.6	x	x	.2	.2	1.1	<1	34.6
206	R	130-163	.5	2.3	3.4	.4	.1	0	4.9	<.1	.6	<.1	.2	13.3	x	x	.2	.2	.8	<1	19.8

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
199	A1	0-7	6.3	5.8	.309	10.9	41	730	1.26	3.9	19.4	1.6	13.8
200	B1	7-20	6.6	4.5	.253	10.3	28	450	.68	2.5	26.6	1.6	17.8
201	B21t	20-38	6.3	1.9	.136	8.1	4	303	.38	.4	19.0	2.3	27.9
202	B22t	38-68	6.5	1.7	.124	8.0	2	195	.65	.3	14.6	1.7	14.0
203	B31ca	68-81	7.5	1.5	.115	7.6	1	165	.57	.3	8.4	1.4	5.0
204	B32ca	81-107	7.8	1.2	.089	7.8	3	115	.21	.3	5.8	1.5	2.9
205	Cca	107-130	8.2	1.3	.090	8.4	3	100	.28	.3	3.8	1.8	1.7
206	R	130-163	7.9	1.1	.076	8.4	4	85	.07	.4	3.[illegible]	1.2	3.9

Appendix Table A-5. (continued)

Site No. 35

Sample No.	Horizon	Depth (cm)	Cond. mmhos/cm	Water Soluble Cations and Anions (me/L)									SAR	CEC me/100g	Exchangeable Cations (me/100g)				ESP	Gypsum me/100g	$CaCO_3$ Equiv. Lime %
				Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3			Ca	Mg	Na	K			
207	A1	0-15	.5	3.5	1.4	.1	.8	0	4.5	.2	.4	.1	.1	35.9	26.8	3.6	.2	1.5	.6	<1	1.6
208	A3	15-31	.4	3.2	1.0	.1	.6	0	4.6	.1	<.1	<.1	.1	30.1	20.5	2.6	.2	1.5	.7	<1	1.6
209	B21t	31-66	.2	1.5	.5	.1	.1	0	1.9	.1	<.1	<.1	.1	24.0	17.1	3.3	.1	.6	.4	<1	1.4
210	B22t	66-94	.2	1.1	.4	.1	.1	0	1.6	.1	<.1	<.1	.1	21.6	15.7	3.2	.2	.4	.9	<1	2.0
211	IIC	94-112	.4	3.0	1.2	.2	.1	0	3.8	<.1	1.0	<.1	.1	16.5	12.0	2.4	.1	.3	.6	<1	1.2
212	IIICca	112-150	.5	1.8	2.5	1.5	.1	0	3.0	2.3	.1	<.1	1.0	20.5	x	x	.5	.3	2.4	<1	12.6

Sample No.	Horizon	Depth (cm)	Sat. pH	Organic Matter %	Total N %	C : N	Bicarb. P (ppm)	NH_4OAc K (ppm)	Hot Water B (ppm)	DTPA Extractable (ppm)			
										Zn	Fe	Cu	Mn
207	A1	0-15	6.8	12.6	.443	16.5	14	580	.81	6.4	30.5	1.0	16.1
208	A3	15-31	6.7	8.0	.343	13.6	11	570	.94	2.5	29.2	.9	16.1
209	B21t	31-66	6.8	3.8	.196	11.3	3	250	.34	.3	22.2	.7	9.6
210	B22t	66-94	6.9	3.4	.183	10.8	3	148	.45	.3	18.0	.6	5.6
211	IIC	94-112	7.1	1.6	.110	8.5	2	105	.26	.6	15.9	.6	7.1
212	IIICca	112-150	8.0	.6	.063	5.5	1	113	.29	1.0	10.4	.4	3.9

Appendix Table A-5. (continued)

Site No. 36

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
1	A11	0-18	3.55	620	20.2	111.0	.249	4.50	.030	13.50	.39	.20
2	A12	18-64	4.05	662	22.0	134.0	.171	1.98	.038	11.70	.23	.17
3	A2	64-71	1.94	460	12.8	72.0	.097	7.90	.044	17.25	.37	.25
4	B&A	71-99	2.29	280	14.8	79.5	.076	6.36	.070	13.30	.41	.10
5	B2t	99-130	2.45	100	14.8	98.2	.052	6.30	.104	13.70	.37	.13
6	C	130-180	2.60	90	18.4	120.5	.048	4.59	.112	14.10	.27	.36

Site No. 1

Appendix Table A-6. Total Fe, Mn, Cu, Zn, Cd, Pb, Hg, As, Se and Mo content of all horizons of soils studied.

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
7	A11	0-25	3.15	755	25.8	104.5	.182	2.64	.030	12.20	.18	.21
8	A12	25-48	3.45	775	26.7	105.0	.170	3.77	.028	11.20	.24	.11
9	A13	48-94	3.50	783	26.7	101.8	.196	3.45	.042	12.55	.33	.22
10	B2	94-119	3.55	280	29.4	81.8	.079	2.43	.050	17.50	.20	.22
11	C	119	4.50	400	24.8	76.5	.080	2.56	.060	17.25	.31	.28

Site No. 2

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
12	A1	0-12	2.55	480	16.50	67.2	.080	6.00	.018	10.90	.31	.40
13	B1	12-28	2.55	440	16.50	79.2	.065	4.10	.018	12.20	.24	.52
14	B2t	28-58	2.70	420	13.80	78.0	.049	3.93	.022	11.00	.25	.40
15	B3ca	58-84	2.22	350	11.45	59.0	.062	6.56	.020	7.25	.17	.19
16	C1ca	84-104	2.29	360	11.9	59.8	.393	3.27	.014	5.19	.19	.14
17	IIC2ca	104-127	2.25	360	9.0	53.0	.062	7.30	.016	6.20	.19	.17
18	IIC3ca	127-150	3.10	440	11.9	73.5	.048	2.65	.014	10.20	.18	.28
19	IIICR	150-195	2.00	170	21.1	76.5	.092	7.78	.032	7.20	.21	.52

Site No. 3

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
20	A11	0-13	2.60	310	14.8	83.3	.059	4.06	.024	7.45	.33	.25
21	A12	13-28	2.95	390	18.4	100.0	.087	1.98	.018	8.25	.39	.25
22	B2	28-56	2.95	320	16.5	94.5	.087	4.42	.022	9.40	.61	.32
23	B3ca	56-82	2.85	270	15.5	91.2	.083	3.46	.030	7.40	.52	.22
24	C1ca	82-134	2.70	240	14.8	86.5	.074	6.01	.028	8.40	.70	.28
25	C2ca	134-183	2.72	255	13.8	85.2	.086	6.56	.052	8.70	.75	.25

Site No. 4

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
26	A21	0-10	2.60	300	16.5	87.5	.079	4.58	.032	9.25	.64	.36
27	A22	10-23	2.40	390	17.4	88.1	.073	3.92	.028	9.70	.59	.22
28	B21t	23-43	2.90	370	17.4	90.4	.078	3.95	.026	9.75	.47	.25
29	B22t	43-56	2.70	260	16.5	85.8	.097	5.04	.022	11.40	.57	.25
30	B23sa	56-112	3.05	270	15.5	81.5	.083	4.91	.026	9.40	.59	.32
31	C	112-173	2.90	270	14.8	82.2	.075	7.67	.046	9.70	.29	.40

Site No. 5

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
32	A11	0-5	2.70	270	18.4	86.5	.138	6.14	.032	8.90	.15	.93
33	A12	5-15	3.20	250	20.2	98.0	.177	4.33	.036	11.00	.45	.32
34	B21	15-25	2.29	170	12.8	85.0	.129	3.24	.046	9.70	.30	.45
35	B22	25-42	2.70	170	13.8	79.2	.116	7.30	.048	9.75	.37	1.41
36	B3ca	42-76	2.60	130	11.9	82.5	.103	4.67	.050	13.00	.27	.52
37	CR	76	2.85	210	12.8	80.5	.153	4.38	.040	7.25	.29	.45

Site No. 6

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
38	A11	0-23	3.00	460	16.5	85.0	.155	4.03	.038	7.40	.12	.25
39	A12	23-56	2.60	470	15.5	83.5	.155	3.15	.036	7.60	.08	.88
40	B1	56-82	2.85	400	15.5	78.8	.195	2.42	.046	7.90	.05	.40
41	B2t	82-124	2.55	340	17.4	74.0	.202	1.16	.034	8.80	.07	1.20
42	C	124-193	1.85	250	12.8	64.4	.151	4.67	.028	7.60	.11	.28

Site No. 7

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
43	Ap	0-25	3.00	650	23.0	80.0	.152	6.05	.020	8.45	.10	.36
44	B21t	25-46	4.35	775	20.2	79.2	.137	1.67	.024	13.90	.13	.01
45	IIB22tb	46-65	6.00	1075	16.95	80.0	.224	1.50	.024	19.20	.14	.19
46	IIB3cab	65-91	3.90	630	14.8	66.1	.118	1.50	.024	11.50	.13	.52
47	IIC1cab	91-162	4.40	783	15.5	73.0	.210	.85	.020	7.40	.07	.52
48	IIC2b	162-175	6.25	1200	18.4	90.5	.201	3.24	.030	17.60	.11	.19
49	IIIA2b	175-190	2.34	410	17.4	67.0	.126	7.12	.034	5.90	.08	1.29
50	IIIB2tb	190-235	3.25	590	17.4	69.8	.122	3.59	.022	10.40	.09	.52
51	IIIC1cab	235-262	2.25	460	13.8	60.5	.178	3.87	.022	7.45	.07	.32
52	IIIC2b	262-325	2.34	370	12.8	53.5	.186	3.59	.018	7.20	.05	.52
x	IVC3b	290-325										

Site No. 8

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
53	A11	0-13	1.94	510	16.5	60.0	.141	4.52	.028	6.80	.04	.52
54	A12	13-36	2.09	570	19.3	80.2	.123	3.84	.034	6.40	.04	.36
55	B21t	36-66	2.88	770	18.4	68.5	.122	7.12	.024	8.60	.09	.41
56	B22t	66-99	3.35	1110	59.8	168.4	.092	7.66	.037	9.70	.06	.52
57	C	99-117	2.60	170	11.0	50.0	.056	3.39	.028	8.90	.04	.52
58	CR	117-152	1.60	130	9.0	43.5	.066	3.34	.018	7.75	.04	.52

Site No. 9

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
59	A1	0-8	4.30	725	23.0	106.0	.181	2.44	.044	10.20	.04	.36
60	B21t	8-18	4.00	600	23.9	100.5	.162	2.98	.036	9.40	.10	.78
61	B22t	18-28	3.70	480	72.3	217.3	.100	5.23	.052	11.10	.07	1.04
62	B23t	28-66	3.75	490	27.6	108.3	.097	4.06	.062	11.70	.05	.40
63	B3	66-87	2.80	300	16.5	86.5	.085	3.62	.046	7.75	.09	.45
64	C	87-128	3.55	430	19.3	91.5	.062	2.30	.050	7.45	.12	.52
65	CR	128-158	2.75	330	17.4	84.4	.061	3.34	.048	5.90	.06	.45

Site No. 10

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
66	A11	0-18	1.55	310	7.4	37.2	.044	5.53	.024	4.75	.08	.37
67	A12	18-36	1.44	290	23.9	153.0	.042	5.49	.024	5.20	.08	.37
68	B1	36-68	1.39	200	4.6	32.5	.026	3.62	.022	5.25	.09	.21
69	B21t	68-120	1.85	160	5.4	44.0	.024	4.42	.023	7.70	.14	.67
70	B22t	120-158	1.85	195	5.85	42.2	.022	3.82	.028	7.80	.09	.25
71	B3	158-190	1.60	230	5.40	38.2	.027	4.73	.028	6.10	.07	.47
72	CR	190-219	0.98	180	3.50	33.0	.017	5.05	.024	4.10	.03	.50

Site No. 11

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
73	A2	0-13	1.55	580	6.3	38.4	.091	8.25	.021	3.40	.05	.60
74	B2t	13-28	1.44	510	12.8	76.3	.116	5.10	.020	3.75	.08	.40
75	B3ca	28-46	1.18	250	5.4	44.0	.088	5.84	.016	3.10	.04	.06
76	C1	46-64	1.70	360	2.8	37.5	.062	4.10	.014	2.75	.06	.19
77	IIC2	64-152	1.55	918	1.9	37.5	.220	1.85	.014	3.30	.03	.14

Site No. 12

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
78	A1	0-12	2.09	210	8.2	64.5	.206	4.13	.029	10.80	.26	.30
79	B21t	12-25	3.20	220	14.8	127.5	.276	2.50	.034	13.80	.36	.47
80	B22t	25-40	2.67	165	12.35	93.0	.293	4.19	.034	11.40	.45	.01
81	B3ca	40-71	2.09	160	8.2	76.0	.225	3.05	.030	10.70	.44	<.01
82	Cca	71-112	2.29	170	11.9	90.2	.187	5.35	.036	9.00	.74	.13
83	C	112-165	2.34	190	11.0	84.2	.267	2.57	.038	10.40	.85	<.01

Site No. 13

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
84	A1	0-13	2.85	580	16.5	82.0	.174	2.84	.030	9.05	.06	.13
85	B2	13-31	2.80	560	13.8	77.5	.211	3.55	.029	9.80	.08	.37
86	B31	31-45	2.85	560	12.8	74.5	.135	3.03	.030	9.55	.09	<.01
87	B32	45-74	3.20	390	8.2	80.0	.098	1.43	.024	7.52	.06	.01
88	R	74-100	1.64	685	15.5	106.0	.117	2.20	.033	5.99	.01	<.01

Site No. 14

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
89	A11	0-36	4.20	705	20.2	84.5	.140	2.81	.031	8.79	.09	.36
90	A12	36-104	1.61	605	19.75	78.2	.104	3.33	.026	5.14	.07	<.01
91	C	104-162	3.20	610	19.3	78.3	.138	3.66	.026	7.55	.07	.37
92	A1b	162-184	3.80	662	19.3	83.5	.148	4.50	.025	6.75	.07	<.01

Site No. 15

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
93	A11	0-20	3.45	570	14.8	71.5	.095	4.59	.030	8.10	.05	.01
94	A12	20-38	3.50	550	14.8	68.2	.083	1.85	.026	8.50	.07	.01
95	A13	38-71	3.65	530	13.8	68.0	.081	2.13	.026	11.40	.07	.28
96	C1	71-132	3.15	400	13.8	65.1	.058	4.13	.034	8.40	.07	<.01
x	R	>132										

Site No. 16

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
97	A1	0-15	3.75	490	17.4	69.0	.105	2.95	.037	10.40	.08	.40
98	B2	15-44	3.95	460	16.5	72.0	.085	2.43	.050	10.80	.11	.25
x	R	44										

Site No. 17

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
99	A11	0-15	3.35	580	19.3	68.2	.048	1.98	.037	12.40	.07	.31
100	A12	15-64	3.43	590	20.2	74.1	.083	1.38	.034	12.90	.10	.40
101	B2t	64-126	4.65	540	33.0	106.2	.151	1.16	.076	27.20	.18	.58
x	R	>126										

Site No. 18

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
102	A1	0-13	2.90	570	15.5	67.0	.104	2.52	.034	9.90	.05	.58
103	B2t	13-28	2.70	530	22.0	138.0	.096	3.04	.026	9.70	.07	.25
104	B3ca	28-61	2.60	480	13.8	62.5	.105	4.10	.026	9.00	.05	.01
105	Cca	61-99	2.60	480	11.9	59.5	.078	2.37	.022	8.70	.11	.13
106	B21tcab	99-144	2.70	500	15.5	64.5	.077	3.86	.026	8.00	.09	.25
107	B22tcab	144-190	2.85	570	18.4	69.8	.085	5.05	.021	11.90	.10	.09
108	B23tcab	190-206	2.75	570	17.4	69.0	.115	4.96	.023	8.20	.14	.25
109	Ccsb	> 206	2.80	600	15.5	70.2	.095	5.37	.022	8.70	.11	.69
x	R											

Site No. 19

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
110	A1	0-10	3.08	630	11.9	67.1	.044	3.72	.035	8.25	.08	.13
111	AC	10-27	2.55	685	11.0	58.8	.044	4.33	.028	5.40	.06	.25
112	Cr	27-40	1.65	755	7.4	44.0	.031	4.03	.048	4.85	.11	.09
113	R	> 40	1.34	1750	2.8	29.9	.034	1.43	.040	8.00	.05	.03

Site No. 20

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
115	A1	0-15	2.34	450	8.2	56.1	.050	6.62	.023	7.60	.60	.32
116	C1	15-41	2.34	410	10.0	56.3	.051	7.42	.021	7.40	.03	.69
117	C2	41-54	1.70	480	9.2	57.5	.056	6.04	.017	7.25	.05	.58
118	C3	54-94	2.34	470	9.2	55.0	.046	5.53	.015	7.15	.07	<.01
119	A1b	94-107	2.00	440	8.2	53.5	.040	5.22	.014	8.00	.06	<.01
120	IIC1	107-127	2.45	440	8.2	55.2	.060	7.77	.014	6.40	.05	<.01
121	IIC2	127-153	2.47	460	7.4	57.5	.053	6.36	.014	6.45	.04	.01
122	IIIC1	153-180	2.55	500	8.2	59.9	.058	7.78	.014	6.10	.08	.01

Site No. 21

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
123	A1	0-30	2.55	450	11.9	65.0	.080	5.77	.023	7.70	.07	<.01
124	A1b	30-46	2.60	520	10.0	67.0	.097	3.86	.022	7.59	.09	.04
125	IIC1	46-99	2.60	460	12.8	65.2	.073	5.40	.020	8.30	.09	<.01
126	IIIA1b	99-110	2.75	550	14.8	68.1	.072	4.50	.032	8.20	.06	<.01
127	IIIC1	110-143	2.09	400	9.2	52.5	.040	4.63	.016	6.75	.10	<.01
128	IIIC2	143-160	2.20	430	6.3	52.0	.040	4.26	.016	6.60	.09	.04
129	IVA1b	160-180	3.25	550	14.8	73.2	.080	5.78	.021	9.30	.10	.04
130	IVC1	180-198	2.80	450	11.9	66.0	.071	5.53	.020	9.00	.17	.04

Site No. 22

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
131	A2	0-8	1.92	640	10.0	45.0	.057	6.43	.023	6.05	.03	.01
132	B2t	8-21	3.20	520	15.5	72.0	.048	3.16	.024	9.60	.08	.01
133	B3ca	21-41	3.15	450	15.5	65.0	.065	6.57	.036	10.80	.12	.13
134	C1ca	41-82	2.20	450	10.0	51.1	.068	5.14	.020	10.75	.09	1.39
135	C2	82-152	2.60	490	12.8	59.5	.063	7.35	.025	8.30	.57	.05
136	IIC1ca	152-200	2.65	560	13.8	60.5	.055	5.93	.018	8.75	.09	.06

Site No. 23

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
137	A1	0-10	2.70	590	12.8	60.8	.019	4.90	.029	4.40	.06	.11
138	B2	10-26	2.95	510	16.5	66.0	.022	4.50	.046	5.17	.10	.40
139	B3ca	26-39	2.52	450	12.65	68.5	.066	4.10	.028	5.03	.04	.16
140	Cca	39-92	2.29	490	11.9	51.0	.027	1.88	.018	5.05	.05	.40
141	C	92-143	2.25	550	15.5	59.8	.077	5.37	.018	4.00	.22	.31
142	IICca	143-200	2.85	580	15.5	66.0	.059	4.34	.013	4.20	.01	.44

Site No. 24

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
143	Ap	0-13	3.05	560	21.1	87.2	.086	5.84	.025	6.20	.06	.50
144	A11	13-37	2.85	540	23.0	79.0	.171	5.52	.024	7.30	.13	.79
145	A12	37-69	2.90	540	23.0	77.5	.374	3.54	.024	5.60	.23	.87
146	C1	69-80	2.60	300	13.8	64.4	.071	6.17	.017	7.35	.14	.50
147	C2	80-104	2.75	300	16.5	70.2	.066	6.17	.019	8.80	.14	.58
148	A1b	104-122	2.90	390	22.0	88.8	.118	5.07	.021	7.20	.08	.62
149	IIC1g	122-158	2.60	270	11.0	61.5	.140	6.78	.016	7.05	.01	.16
150	IIC2g	158-204	2.60	260	14.8	66.0	.028	6.87	.017	5.08	.01	.31

Site No. 25

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
151	A1	0-13	2.34	370	8.2	50.2	.021	6.26	.027	5.10	.13	.62
152	C1	13-23	2.20	260	7.4	50.4	.019	4.18	.026	5.07	.04	.06
153	Cr	23-41	1.80	260	6.3	46.5	.020	2.92	.020	2.90	.09	.06
154	R	>41	1.94	260	7.4	52.2	.017	5.49	.020	2.50	.09	.44

Site No. 26

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
155	A1	0-11	2.85	550	12.8	70.0	.023	9.12	.024	6.10	.10	.31
156	B2	11-30	2.60	500	12.8	68.0	.031	6.13	.024	4.20	.13	.21
157	C1	30-56	2.60	505	12.35	71.2	.035	2.82	.020	2.70	.11	.58
x	R	>56										

Site No. 27

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
159	A1	0-8	3.10	560	24.8	107.0	.078	6.83	.038	3.75	.38	.06
160	B21	8-15	2.95	445	23.9	125.5	.040	3.93	.035	8.40	.41	.21
161	B22	15-46	3.75	420	21.1	117.5	.030	2.96	.034	7.25	.32	.21
162	B3	46-71	3.55	390	18.4	109.2	.045	4.72	.042	8.40	.16	.54
163	C	71-81	3.50	480	23.0	111.8	.049	4.39	.062	6.90	.09	.21
164	CR	>81	3.75	673	28.4	128.5	.079	7.71	.070	16.40	.21	.44

Site No. 28

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
165	A11	0-36	2.15	695	11.9	60.2	.114	5.84	.027	3.70	.11	.40
166	A12	36-66	2.05	380	10.0	63.0	.107	4.34	.020	6.10	.16	.36
167	A2b	66-77	2.15	340	8.2	61.0	.090	3.87	.020	5.10	.12	.54
168	B&Ab	77-118	2.85	410	11.0	72.8	.086	1.27	.020	6.10	.07	.80
169	B21tb	118-178	2.85	360	16.5	71.5	.094	3.34	.026	6.40	.12	.11
170	B22tb	178-234	2.75	430	15.5	72.0	.133	1.86	.027	6.30	.09	.40
171	C	234-254	2.50	370	13.8	69.0	.093	4.62	.020	5.60	.01	<.01
x	R	> 254										

Site No. 29

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
172	A11	0-13	2.34	620	12.8	53.0	.106	2.35	.028	4.00	.04	.36
173	A12	13-47	2.09	610	12.8	54.0	.118	5.49	.026	4.50	.05	<.01
174	A13	47-89	2.00	580	11.9	55.0	.098	3.54	.026	4.00	.09	<.01
175	B2	89-127	2.25	580	11.0	50.0	.068	1.98	.028	4.60	.17	<.01
x	Cr	>127										

Site No. 30

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
176	A1	0-8	3.35	380	25.8	104.2	.458	2.10	.024	9.50	.20	.80
177	B21	8-26	3.50	360	23.0	101.2	.498	4.39	.022	7.30	.05	1.13
178	B22	26-89	3.50	340	23.0	104.2	.572	4.30	.016	10.50	.39	1.19
179	B3cacs	89-122	3.30	310	22.0	101.8	.388	8.52	.025	6.40	.55	1.58
x	Cr	122-148										

Site No. 31

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
180	A2	0-5	2.55	465	22.0	83.5	.230	7.71	.024	7.10	.29	.95
181	B21t	5-23	2.90	410	23.0	101.0	.490	3.92	.021	7.30	.08	.80
182	B22tsa	23-64	2.40	310	22.0	99.9	.370	3.72	.020	7.30	.60	.40
183	B3sa	64-104	3.10	350	23.0	102.5	.431	5.06	.021	9.25	.47	.80
184	Csacs	104-155	3.15	460	24.8	105.5	.393	6.05	.020	8.70	.30	.76

Site No. 32

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
185	A1	0-13	3.30	640	20.2	90.2	.102	6.41	.028	6.80	.23	.40
186	C1	13-23	2.20	340	5.4	45.5	.028	5.85	.016	6.00	.07	.44
187	A1bg	23-69	4.10	673	19.3	94.5	.151	7.12	.023	7.10	.11	.50
188	C2b1g	69-94	2.85	500	16.5	73.0	.077	4.60	.022	6.75	.12	.21
189	C3b2g	94-119	2.34	420	10.0	56.8	.065	5.58	.020	5.80	.12	.06

Site No. 33

Appendix Table 6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
190	A1	0-5	4.05	685	19.3	110.5	.352	3.24	.027	9.50	.05	<.01
191	A2	5-10	3.50	580	25.8	99.7	.187	4.80	.024	10.45	.10	.11
192	B&A	10-23	3.20	510	25.8	112.5	.143	4.80	.025	10.75	.08	.25
193	B21t	23-39	2.55	220	25.8	103.8	.111	4.14	.044	6.95	.16	.21
194	B22t	39-56	2.29	210	25.8	84.2	.140	3.72	.047	8.80	.05	.40
195	B3tca	56-79	1.24	120	24.8	73.0	.142	6.61	.051	5.50	.14	.16
196	Cca	79-100	1.18	55	27.6	92.1	.175	9.65	.052	5.00	.25	.21
197	Ccs	100-153	1.60	180	33.0	88.1	.246	6.88	.051	4.90	.09	.21
198	Cr	153-165	2.45	260	37.6	160.5	.350	3.00	.071	6.20	.16	.44

Site No. 34

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
199	A1	0-7	3.05	765	29.4	114.5	.570	5.01	.036	6.05	.02	.54
200	B1	7-20	3.23	814	32.2	124.0	.322	5.54	.028	7.45	.05	.36
201	B21t	20-38	3.45	725	31.2	120.1	.465	5.05	.028	8.51	.10	.21
202	B22t	38-68	3.00	630	29.4	118.1	.213	4.34	.041	7.20	.06	.44
203	B31ca	68-81	3.55	640	30.2	119.8	.236	7.08	.047	5.06	.06	.21
204	B32ca	81-107	2.15	500	28.5	99.8	.200	8.08	.047	5.09	.02	.40
205	Cca	107-130	1.60	410	21.1	84.8	.247	8.02	.044	4.75	.05	.40
206	R	130-163	1.60	460	10.0	60.0	.166	5.85	.032	5.40	.01	.21

Site No. 35

Appendix Table A-6. (continued)

Sample No.	Horizon	Depth (cm)	Fe %	Mn (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Hg (ppm)	As (ppm)	Se (ppm)	Mo (ppm)
207	A1	0-15	3.10	805	30.2	124.5	.456	4.07	.036	5.20	.06	.80
208	A3	15-31	3.00	845	30.2	109.0	.287	5.14	.032	6.10	.02	1.03
209	B21t	31-66	3.25	673	24.8	95.2	.254	3.78	.040	7.40	.08	1.52
210	B22t	66-94	3.35	640	20.2	82.5	.107	4.01	.041	7.20	.06	1.07
211	IIC	94-112	7.08	1350	17.4	94.7	.268	2.44	.042	10.05	.24	.06
212	IIICca	112-150	1.34	55	28.5	85.0	.169	4.01	.073	2.75	.03	1.03

Site No. 36

Appendix Table A-6. (continued)

Appendix Table A-7. Estimated engineering properties of soils studied.

Site No.	Depth from Surface (cm)	Classification			Coarse fragments greater than 75 mm	Percentage of less than 75 mm passing through sieve				Liquid limit	Plasticity index	Permeability in/hr	Available water capacity in/in	pH	Salinity mmhos/cm	Shrink-swell potential
		Dominant USDA texture	Unified	AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.4 mm)	No. 200 (0.074 mm)							
1	0-64	Silty clay loam	CL, CH	A-7	5-10	85-95	80-85	75-85	70-75	50	20-40	0.2-0.6	0.19-0.21	6.8	.5	Moderate
1	64-71	Cobbly silt loam	CL	A-6	25-35	85-95	80-90	80-90	70-80	46	15-25	0.6-2.0	0.16-0.18	7.0	.3	Low
1	71-99	Very flaggy silt clay loam	CL	A-7	60-70	80-95	65-75	65-75	60-70	41	15-25	0.6-2.0	0.15-0.17	6.8	.3	Moderate
1	99-180	Very flaggy silt clay	CL, CH	A-7	60-70	80-95	60-70	60-70	60-70	45	20-35	0.6-2.0	0.13-0.15	5.7	.2	High
2	0-25	Loam	ML, CL	A-7	---	90-100	90-95	85-95	70-80	42	10-20	0.6-2.0	0.16-0.18	6.8	.7	Low
2	25-132	Clay loam	CL	A-7	---	85-95	80-90	70-80	55-65	42	10-20	0.2-0.6	0.19-0.21	6.8	.5	Moderate
3	0-12	Loam	ML	A-4	---	95-100	95-100	90-100	60-70	27	NP-5	0.6-2.0	0.16-0.18	7.8	.6	Low
3	12-58	Clay loam	CL	A-6	---	85-100	80-90	75-85	60-70	40	15-25	0.2-0.6	0.19-0.21	7.4	.3	Moderate
3	58-104	Loam	ML	A-4	---	80-100	75-85	75-80	60-65	37	5-15	0.6-2.0	0.16-0.18	8.5	.4	Low
3	104-127	Gravelly sandy clay	SC	A-6	5-10	75-95	70-75	60-70	35-45	27	10-15	2.0-6.0	0.13-0.15	8.7	.4	Low
3	127-150	Very gravelly sandy loam	SM	A-2	---	55-85	40-50	30-40	10-15	21	NP-5	6.0-20	0.07-0.09	8.8	.5	Low
4	0-13	Silty loam	CL	A-6	---	90-100	85-95	85-95	75-85	36	15-25	0.6-2.0	0.19-0.21	8.4	.5	Low
4	13-183	Silty clay loam	CL	A-7	---	85-100	85-95	85-90	75-85	44	15-30	0.2-0.6	0.19-0.21	8.5	7.9	Moderate
5	0-10	Clay loam	CL	A-6	---	90-100	90-95	85-95	75-85	38	15-25	0.2-0.6	0.19-0.21	7.9	1.1	Moderate
5	10-23	Silty loam	ML	A-4	---	90-100	90-95	85-95	75-85	38	5-10	0.6-2.0	0.19-0.21	8.1	.7	Low
5	23-56	Silty clay loam	CL	A-7	---	85-95	85-95	85-95	75-85	44	20-30	0.2-0.6	0.19-0.21	8.3	.8	Moderate
5	56-112	Clay loam	CL	A-7	---	85-95	80-90	80-90	70-80	41	20-30	0.2-0.6	0.19-0.21	8.6	5.6	Moderate
5	112-171	Silty clay loam	CL	A-7	---	80-95	75-85	75-85	65-75	40	20-30	0.2-0.6	0.19-0.21	8.7	20.0	Moderate
6	0-5	Silty loam	ML	A-4	---	95-100	95-100	95-100	85-90	36	5-10	0.6-2.0	0.19-0.21	7.3	.6	Low
6	5-76	Silty clay loam	CL	A-7	---	85-100	85-95	85-95	80-90	38	20-40	0.2-0.6	0.19-0.21	7.3	.4	Moderate

Appendix Table A-7. Estimated engineering properties of soils studied.

Site No.	Depth from Surface (cm)	Classification: Dominant USDA texture	Classification: Unified	Classification: AASHO	Coarse fragments greater than 75 mm	Percentage of less than 75 mm passing through sieve: No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.4 mm)	No. 200 (0.074 mm)	Liquid limit	Plasticity index	Permeability in/hr	Available water capacity in/in	pH	Salinity mmhos/cm	Shrink-swell potential
7	0-56	Loam	ML	A-4	5-10	80-90	75-85	75-85	55-65	36	5-10	0.6-2.0	0.16-0.18	7.1	.5	Low
7	56-82	Very gravelly loam	SC	A-2, A-4	5-10	50-70	40-50	40-50	30-40	34	10-20	2.0-6.0	0.13-0.15	7.5	.4	Low
7	82-124	Gravelly silt loam	CL	A-6	5-10	70-80	65-70	60-70	50-60	35	10-20	2.0-6.0	0.17-0.19	7.5	.3	Low
7	124-193	Extremely cobbly loam	GC, SC	A-1, A-2	50-60	40-60	35-45	25-35	25-35	31	5-10	2.0-6.0	0.12-0.14	7.5	.4	Low
8	0-25	Loam	ML	A-4	---	80-100	75-85	75-80	55-65	35	5-10	0.6-2.0	0.16-0.18	7.1	.3	Low
8	25-65	Clay loam	CL	A-6	0-5	90-100	90-95	85-95	65-75	40	15-25	0.2-0.6	0.19-0.21	7.5	.4	Moderate
8	65-91	Very gravelly sandy clay loam	SC	A-2	0-5	50-80	20-30	20-30	15-25	34	10-20	2.0-6.0	0.10-0.12	8.0	.4	Low
8	91-162	Gravelly loam	SC, SM	A-2, A-4	0-5	65-85	55-65	50-60	30-40	31	5-15	2.0-6.0	0.14-0.16	8.0	.6	Low
8	162-175	Very gravelly sandy loam	GM	A-1	0-5	30-60	15-25	15-20	10-15	25	NP-5	6.0-20	0.07-0.09	8.1	.5	Low
8	175-190	Silt clay loam	CL	A-6	---	85-100	80-90	80-90	70-80	39	15-25	0.2-0.6	0.19-0.21	8.1	.5	Moderate
8	190-235	Clay loam	CL	A-6	---	85-100	80-90	80-90	60-70	30	10-20	0.2-0.6	0.19-0.21	8.0	.5	Moderate
8	235-290	Loam	CL, ML	A-4, A-6	---	85-100	80-90	80-90	60-70	37	5-15	0.6-2.0	0.16-0.18	8.1	.4	Low
9	0-36	Loam	ML	A-4	---	95-100	95-100	95-100	70-80	32	NP-10	0.6-2.0	0.16-0.18	6.4	.5	Low
9	36-99	Clay loam	CL	A-6	---	90-100	90-95	85-95	70-80	39	15-25	0.2-0.6	0.19-0.21	6.3	.3	Moderate
9	99-117	Loam	ML	A-4	---	85-100	80-90	80-90	60-70	32	NP-10	0.6-2.0	0.16-0.18	7.0	.3	Low
10	0-8	Clay loam	CL, CH	A-7	---	85-100	85-95	85-95	70-75	50	20-40	0.2-0.6	0.19-0.21	7.1	.9	Moderate
10	8-18	Silt clay	CL	A-7	---	85-100	80-90	80-85	70-85	47	20-40	0.2-0.6	0.15-0.17	7.3	.5	High
10	18-28	Clay	CH	A-7	---	80-95	75-85	75-85	70-80	51	20-40	.06-0.2	0.14-0.16	7.2	.4	High
10	28-87	Silt clay	CL, CH	A-7	---	85-95	85-95	85-95	80-90	48	20-40	0.2-0.6	0.15-0.17	7.7	.4	High
10	87-128	Gravelly silt clay	CL	A-6, A-7	---	60-80	50-60	50-60	50-60	40	15-25	0.6-2.0	0.13-0.15	7.9	.4	High

Appendix Table A-7. Estimated engineering properties of soils studied.

Site No.	Depth from Surface (cm)	Classification			Coarse fragments greater than 75 mm	Percentage of less than 75 mm passing through sieve				Liquid limit	Plasticity index	Permeability in/hr	Available water capacity in/in	pH	Salinity mmhos/cm	Shrink-swell potential
		Dominant USDA texture	Unified	AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.4 mm)	No. 200 (0.074 mm)							
11	0-68	Sandy loam	SM	A-4	---	95-100	95-100	95-100	45-50	26	NP-5	2.0-6.0	0.11-0.13	6.9	.3	Low
11	68-120	Sandy clay loam	SC, CL	A-6	---	90-100	85-95	85-95	45-55	31	10-20	0.6-2.0	0.14-0.16	6.3	.2	Low
11	120-190	Sandy loam	SM	A-4	---	95-100	95-100	95-100	40-50	26	NP-5	2.0-6.0	0.11-0.13	6.7	.3	Low
12	0-13	Sandy loam	SM	A-4	---	95-100	95-100	95-100	45-50	19	NP-5	2.0-6.0	0.11-0.13	7.4	1.0	Low
12	13-28	Sandy clay loam	SC	A-6	---	90-100	85-95	90-100	45-55	40	15-30	0.6-2.0	0.14-0.16	9.2	3.9	Low
12	28-46	Sandy loam	SM	A-4	---	90-100	85-95	85-90	35-45	40	NP-10	2.0-6.0	0.11-0.13	9.9	9.9	Low
12	46-64	Loamy sand	SM	A-2	---	95-100	90-100	75-85	20-30	27	NP-5	6.0-20	0.06-0.08	10.0	11.2	Low
12	64-152	Extremely cobbly loamy sand	GM-GC	A-1	40-50	30-50	10-20	10-15	5-15	23	5-10	>20	0.04-0.06	10.0	16.5	Low
13	0-12	Loam	ML	A-4	---	95-100	95-100	90-100	75-85	29	NP-10	0.6-2.0	0.16-0.18	7.7	.8	Low
13	12-25	Clay	CL	A-7	---	90-100	90-95	85-95	75-85	43	20-30	0.06-.2	0.14-0.16	7.7	.5	High
13	25-71	Clay loam	CL	A-6, A-7	---	85-95	75-85	75-85	65-75	41	15-25	0.2-0.6	0.19-0.21	8.3	.4	Moderate
13	71-165	Loam	CL	A-6	---	85-95	80-90	75-85	60-70	35	10-20	0.6-2.0	0.16-0.18	8.7	.7	Low
14	0-45	Silt loam	CL	A-6	---	85-100	85-95	85-90	70-80	42	15-25	0.6-2.0	0.19-0.21	6.7	.6	Low
14	45-74	Very gravelly silt clay loam	SC	A-2	---	40-60	20-30	20-30	20-30	44	15-25	0.6-2.0	0.16-0.18	7.8	.5	Moderate
15	0-184	Loam	CL	A-6	---	90-100	90-100	90-100	65-75	43	15-25	0.6-2.0	0.16-0.18	7.1	.4	Low
16	0-38	Loam	ML	A-4	---	95-100	95-100	85-95	50-60	39	5-10	0.6-2.0	0.16-0.18	6.6	.4	Low
16	38-71	Sandy loam	SM	A-4	---	95-100	95-100	85-95	45-55	37	NP-10	2.0-6.0	0.11-0.13	6.8	.3	Low
16	71-112	Channery sandy loam	SM	A-2	---	50-60	50-60	40-45	10-20	36	NP-10	6.0-20	0.09-0.11	7.3	.4	Low

Appendix Table A-7. Estimated engineering properties of soils studied.

Site No.	Depth from Surface (cm)	Classification			Coarse fragments greater than 75 mm	Percentage of less than 75 mm passing through sieve				Liquid limit	Plasticity index	Permeability in/hr	Available water capacity in/in	pH	Salinity mmhos/cm	Shrink-swell potential
		Dominant USDA texture	Unified	AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.4 mm)	No. 200 (0.074 mm)							
17	0-15	Very channery sandy clay loam	GC	A-2	---	45-50	45-50	40-45	20-30	40	10-20	2.0-6.0	0.10-0.12	6.9	.4	Low
17	15-44	Extremely flaggy loam	GC	A-2	30-40	20-40	15-25	15-25	10-20	45	10-20	2.0-6.0	0.11-0.13	7.6	.5	Low
18	0-64	Clay loam	CL, CH	A-7	---	90-100	90-100	85-95	70-80	52	20-40	0.2-0.6	0.19-0.21	6.4	.3	Moderate
18	64-126	Very cobbly clay loam	SC	A-7	15-25	55-65	50-55	45-55	40-50	63	20-40	0.6-2.0	0.15-0.17	6.7	.3	Moderate
19	0-13	Loam	CL	A-6	---	95-100	95-100	95-100	70-80	38	15-25	0.6-2.0	0.16-0.18	7.2	.4	Low
19	13-28	Clay loam	CL	A-7	---	80-95	75-85	75-85	60-70	43	15-25	0.2-0.6	0.19-0.21	7.9	.4	Moderate
19	28-61	Silt loam	CL	A-6	---	80-95	75-85	75-85	60-70	44	15-25	0.6-2.0	0.19-0.21	8.0	.3	Low
19	61-99	Loam	CL	A-6	---	90-100	90-95	85-95	65-75	43	15-25	0.6-2.0	0.16-0.18	8.4	.6	Low
19	99-144	Silt loam	CL	A-6	---	95-100	95-100	90-100	75-85	44	15-25	0.6-2.0	0.19-0.21	8.6	1.5	Low
19	144-190	Loam	CL	A-6	---	95-100	95-100	90-100	70-80	48	20-30	0.6-2.0	0.16-0.18	8.5	7.1	Low
19	190-206	Clay loam	CL	A-7	---	85-100	85-95	85-95	65-75	45	15-30	0.2-0.6	0.19-0.21	8.4	11.2	Moderate
19	206-245	Loam	CL	A-6	---	90-100	90-100	90-100	70-80	42	15-25	0.6-2.0	0.16-0.18	8.2	13.0	Low
20	0-27	Loam	ML	A-4	5-15	90-100	90-100	85-95	55-65	40	5-10	0.6-2.0	0.16-0.18	7.8	.5	Low
20	27-40	Very channery loam	GM	A-1	---	30-50	25-30	20-30	15-25	47	NP-10	2.0-6.0	0.13-0.15	8.2	.4	Low
21	0-127	Channery sandy loam	SM	A-2	---	70-90	65-75	50-60	20-30	27	NP-10	2.0-6.0	0.09-0.11	8.4	.9	Low
21	127-180	Channery loamy sand	SM	A-2	---	60-80	55-60	35-45	10-20	26	NP-10	6.0-20	0.04-0.06	8.5	6.6	Low
22	0-99	Silt loam	ML	A-4	---	95-100	95-100	95-100	70-80	34	NP-10	0.6-2.0	0.19-0.21	8.3	1.4	Low
22	99-110	Loam	ML	A-4	---	95-100	95-100	90-100	65-75	38	5-10	0.6-2.0	0.16-0.18	8.6	5.5	Low
22	110-160	Sandy loam	SM	A-4	---	95-100	95-100	90-100	40-45	29	NP-5	2.0-6.0	0.11-0.13	8.3	9.7	Low
22	160-198	Silt loam	ML	A-4	---	95-100	95-100	95-100	80-85	36	NP-10	0.6-2.0	0.19-0.21	8.0	14.3	Low

Appendix Table A-7. Estimated engineering properties of soils studied.

Site No.	Depth from Surface (cm)	Classification: Dominant USDA texture	Classification: Unified	Classification: AASHO	Coarse fragments greater than 75 mm	Percentage of less than 75 mm passing through sieve: No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.4 mm)	No. 200 (0.074 mm)	Liquid limit	Plasticity index	Permeability in/hr	Available water capacity in/in	pH	Salinity mmhos/cm	Shrink-swell potential
23	0-8	Loam	ML	A-4	---	95-100	95-100	85-95	60-70	26	NP-5	0.6-2.0	0.16-0.18	7.6	7	Low
23	8-21	Silt clay	CH	A-7	---	95-100	95-100	90-100	80-90	61	30-40	0.2-0.6	0.15-0.17	7.8	.8	High
23	21-41	Silt clay loam	CL, CH	A-7	---	95-100	95-100	90-100	80-90	51	20-30	0.2-0.6	0.19-0.21	8.2	1.6	Moderate
23	41-200	Loam	ML	A-4	---	95-100	95-100	90-100	75-80	42	5-10	0.6-2.0	0.16-0.18	8.4	10.0	Low
24	0-10	Loam	ML	A-4	---	95-100	95-100	90-95	60-70	33	5-10	0.6-2.0	0.16-0.18	7.8	.7	Low
24	10-26	Clay loam	CL	A-7	---	95-100	95-100	95-100	80-90	46	15-25	0.2-0.6	0.19-0.21	7.6	.5	Moderate
24	26-39	Silt clay loam	CL	A-6, A-7	---	95-100	95-100	95-100	80-90	44	15-25	0.2-0.6	0.19-0.21	8.0	.6	Moderate
24	39-200	Loam	ML	A-7	---	95-100	95-100	95-100	75-85	43	10-20	0.6-2.0	0.16-0.18	8.5	7.9	Low
25	0-37	Silt clay	CH, MH	A-7	---	95-100	95-100	95-100	95-100	65	30-40	0.2-0.6	0.15-0.17	8.0	1.6	High
25	37-69	Silt clay loam	MH	A-7	---	95-100	95-100	95-100	90-100	69	20-35	0.2-0.6	0.19-0.21	8.1	5.4	Moderate
25	69-80	Sandy loam	SM	A-4	---	95-100	95-100	95-100	50-60	33	NP-10	2.0-6.0	0.11-0.13	8.5	3.0	Low
25	80-122	Silt clay loam	MH	A-7	---	95-100	95-100	95-100	90-100	59	20-30	0.2-0.6	0.19-0.21	8.6	1.5	Moderate
25	122-158	Sandy loam	SM-SC	A-2, A-4	---	80-95	75-85	60-70	35-45	39	NP-10	2.0-6.0	0.11-0.13	8.4	1.3	Low
25	158-204	Loam	ML	A-4	---	90-100	90-95	80-90	55-65	38	NP-10	0.6-2.0	0.16-0.18	8.3	1.2	Low
26	0-23	Very channery sandy loam	SM	A-2	0-10	45-65	40-45	35-45	15-25	45	NP-10	6.0-20	0.07-0.09	8.2	.4	Low
26	23-41	Very channery loam	SM	A-2	0-10	45-55	25-35	25-30	15-25	43	NP-10	2.0-6.0	0.12-0.14	8.3	.4	Low
26	41	Extremely channery sandy l	GP, GM	A-1	20-30	20-40	10-20	10-20	5-10	32	NP-5	6.0-20	0.07-0.09	8.8	.4	Low
27	0-56	Loam	ML, CL	A-4, A-6	---	85-100	85-90	75-85	55-65	39	5-15	0.6-2.0	0.16-0.18	7.9	.7	Low

Appendix Table A-7. Estimated engineering properties of soils studied.

Site No.	Depth from Surface (cm)	Classification			Coarse fragments greater than 75 mm	Percentage of less than 75 mm passing through sieve				Liquid limit	Plasticity index	Permeability in/hr	Available water capacity in/in	pH	Salinity mmhos/cm	Shrink-swell potential
		Dominant USDA texture	Unified	AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.4 mm)	No. 200 (0.074 mm)							
28	0-8	Silt clay loam	CL	A-7	---	90-100	90-100	90-100	80-90	48	20-30	0.2-0.6	0.19-0.21	6.5	.7	Moderate
28	8-71	Clay	CL, CH	A-7	---	85-100	85-95	85-95	80-90	48	20-40	0.06-0.2	0.14-.16	7.7	.4	High
28	71-81	Silt clay	CL, CH	A-7	---	85-95	80-90	80-90	80-90	46	20-40	0.2-0.6	0.15-0.17	8.3	.4	High
29	0-36	Sandy clay loam	SC	A-6	---	85-100	85-95	70-80	45-50	37	10-20	0.6-2.0	0.14-0.16	6.5	.4	Low
29	36-77	Loam	ML	A-4	---	85-100	85-95	85-90	65-75	32	NP-10	0.6-2.0	0.16-0.18	6.7	.3	Low
29	77-234	Clay loam	CL	A-6	---	80-95	75-85	75-85	65-75	38	15-25	0.2-0.6	0.19-0.21	7.2	.3	Moderate
29	234-254	Loam	ML	A-4	---	80-95	75-80	70-80	60-70	35	NP-10	0.6-2.0	0.16-0.18	8.0	.4	Low
30	0-127	Silt loam	ML	A-4	---	85-100	85-95	80-90	70-80	35	5-10	0.6-2.0	0.19-0.21	6.5	.4	Low
31	0-8	Silt clay	CH	A-7	---	90-100	90-100	90-100	85-95	55	25-40	0.2-0.6	0.15-0.17	7.8	.9	High
31	8-89	Clay	CH	A-7	---	80-95	80-90	80-85	75-85	61	30-40	0.06-.2	0.14-0.16	8.2	.7	High
31	89-122	Silt	ML	A-4	---	90-100	90-95	90-95	85-95	50	NP-10	0.2-2.0	0.15-0.17	8.1	7.7	Low
32	0-23	Silt clay loam	CL	A-7	---	85-95	85-90	80-90	80-90	44	20-30	0.2-0.6	0.19-0.21	6.9	1.1	High
32	23-155	Silt clay	CH, CL	A-7	---	85-100	85-95	85-95	80-90	54	20-40	0.2-0.6	0.15-0.17	8.4	23.7	High
33	0-13	Silt clay loam	CH, MH	A-7	---	85-100	85-95	85-95	85-95	83	40-50	0.2-0.6	0.15-0.17	-	6.2	High
33	13-23	Sandy clay	-	-	---	95-100	95-100	95-100	45-55	24	-	2.0-6.0	0.11-0.13	-	2.2	Low
33	23-93	Silt clay loam	-	-	---	90-100	90-100	90-95	80-90	61	-	0.2-0.6	0.19-0.21	-	2.5	Moderate
33	93-118	Loam	-	-	---	95-100	95-100	95-100	55-65	35	-	0.6-2.0	0.16-0.18	-	2.5	Low

Appendix Table A-7. Estimated engineering properties of soils studied.

Site No.	Depth from Surface (cm)	Classification: Dominant USDA texture	Classification: Unified	Classification: AASHO	Coarse fragments greater than 75 mm	Percentage of less than 75 mm passing through sieve: No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.4 mm)	No. 200 (0.074 mm)	Liquid limit	Plasticity index	Permeability in/hr	Available water capacity in/in	pH	Salinity mmhos/cm	Shrink-swell potential
34	0-5	Sandy loam	SM	A-4	---	90-100	90-100	80-90	45-55	38	NP-10	2.0-6.0	0.11-0.13	6.9	1.0	Low
34	5-10	Loam	ML	A-4	---	85-100	85-95	85-95	65-75	31	NP-10	0.6-2.0	0.16-0.18	6.9	.6	Low
34	10-23	Clay loam	CL	A-6, A-7	---	85-100	85-95	85-90	65-75	41	20-30	0.2-0.6	0.19-0.21	6.6	.4	Moderate
34	23-56	Clay	CH	A-7	---	85-100	85-90	85-90	75-85	54	30-50	0.06-0.2	0.14-0.16	7.5	.6	High
34	56-101	Silt clay	CL	A-7	---	95-100	95-100	95-100	85-95	45	20-35	0.2-0.6	0.15-0.17	8.4	5.5	High
34	100-165	Gravelly silt clay	CL, CH	A-7	---	70-90	65-70	65-70	60-70	48	25-40	0.6-2.0	0.13-0.15	8.3	6.1	High
35	0-20	Clay loam	CL	A-7	---	95-100	95-100	95-100	80-85	45	15-25	0.2-0.6	0.19-0.21	6.5	.6	Moderate
35	20-38	Silt clay	CL	A-7	---	85-100	85-90	80-90	75-80	47	20-30	0.2-0.6	0.15-0.17	6.3	.2	High
35	38-68	Gravelly clay	CH	A-7	---	75-90	70-75	65-75	60-70	53	30-50	0.2-0.6	0.14-0.16	6.5	.2	High
35	68-107	Gravelly silt clay	CL, CH	A-7	---	75-85	65-75	65-70	60-65	49	20-40	0.6-2.0	0.13-0.15	7.7	.4	High
35	107-130	Gravelly clay	CL, CH	A-7	---	55-75	50-60	50-60	45-55	56	20-40	0.2-0.6	0.14-0.16	8.2	.4	High
36	0-31	Silt clay loam	CH, MH	A-7	---	90-100	90-100	90-100	80-90	54	20-30	0.2-0.6	0.19-0.21	6.8	.5	Moderate
36	31-66	Gravelly silt clay	CL, CH	A-7	---	75-85	65-75	65-70	55-65	51	20-40	0.6-2.0	0.13-0.15	6.8	.2	High
36	66-94	Clay loam	CL	A-7	---	80-90	70-80	70-80	60-70	45	20-30	0.2-0.6	0.19-0.21	6.9	.2	Moderate
36	94-112	Very gravelly loam	SC	A-2	---	45-65	35-45	35-45	25-35	37	10-20	2.0-6.0	0.13-0.15	7.1	.4	Moderate
36	112-150	Silt clay	CL, CH	A-7	---	80-100	75-85	75-85	75-85	49	25-45	0.2-0.6	0.15-0.17	8.0	.5	High

APPENDIX B

ASSOCIATED NATIVE VEGETATION

Site 1
Aspen Trees, Snowberry, Chokecherry, Currant, Mountain Brome, Bluegrasses, Blue Wildrye Grass, Needlegrasses, Sweet Anise, Colorado Columbine, Tall Bluebells, Arnica, Oregon Grape.

Site 2
Big Sagebrush, Mountain Silver Sagebrush, Bluegrasses, Tall Rabbitbrush, Needlegrasses, Bromes, Fescues, Bluebells, Lupin, Bitterwood, Yarrow, Bedstraw, Dandelion, Snowberry, Lomatium.

Site 3
Big Sagebrush, Western Wheatgrass, Low Rabbitbrush, Squirreltail, Phlox, Lupine, Hollyleaf Clover, Pussytoes, Sandberry, Bluegrass, Junegrass.

Site 4
Big Sagebrush, Tall Rabbitbrush, Western Wheatgrass, Bluebunch Wheatgrass, Squirreltail, Sandberg Bluegrass, Nevada Bluegrass, Salina Wildrye Grass, Winterfat, Hollyleaf Clover, Longleaf Phlox, Globemallow, Astragalus, Snakeweed.

Site 5
Big Sagebrush, Greasewood, Shadscale, Western Wheatgrass, Bluebunch Wheatgrass, Salina Wildrye Grass, Sandberg Bluegrass, Longleaf Phlox, Hoods Phlox, Fleabane, Hollyleaf Clover, Astragalus, Pussytoes, Onion, Cactus, Rock Cress.

Site 6
Big Sagebrush, Western Wheatgrass, Bluebunch Wheatgrass, Salina Wildrye, Nevada Bluegrass, Sandberg Bluegrass, Muttongrass, Serviceberry, Squirreltail, Longleaf Phlox, Hoods Phlox, Onion, Bluebells, Globemallo, Milkvetch, False Dandelions, Astragalus, Hollyleaf Clover, Lomatium, Crepis, Indian Paintbrush, Western Wallflower, Bladderpod.

Site 7
Gambell Oak, Chokecherry, Serviceberry, Snowberry, Rose, Ribes, Lomatium, Geranium, Meadow Rue, Penstemon, Butterweed, Arnica, Peavine, Columbine, Bedstraw, Yellow Violet, Balsamroot, Bromes, Needlegrasses, Bluegrasses, Elk Sedge.

Site 8
(Wheat Stubble), Big Sagebrush, Low Rabbitbrush, Winterfat, Western Wheatgrass, Bluebunch Wheatgrass, Prairie Junegrass, Nevada Bluegrass, Muttongrass, Sandberg Bluegrass, Pussytoes, Hollyleaf Clover, Fleabane, Longleaf Phlox, Globemallow, Cactus, Death Cama, Indian Paintbrush, Yarrow.

Site 9
Needlegrass, Mountain Brome, Slender Wheatgrass, Sedge, Bluegrasses, Lupine, Peavine, Bluebells, Yarrow Gumwood, Dandelion, Herbaceous

Sage, Tall Rabbitbrush, Snowberry, Big Sagebrush.

Site 10
Needlegrass, Mountain Brome, Bluegrasses, Nevada Bluegrass, Western Wheatgrass, Bluebells, Astragalus, Waterleaf, Groundsel, Balsamroot, Lupine, Noneleaf Lomatium, Yellow Violet, Geranium, Hollyleaf clover, Peavine, Yarrow, Thistle Onion, Snowberry, Big Sagebrush, Gambell Oak, Serviceberry, Small Rabbitbrush.

Site 11
Elk Sedge, Bluegrasses, Prairie Junegrass, Needlegrasses, Mountain Brome, Chokecherry, Gambell Oak, Serviceberry, Snowberry, Bitterbrush, Big Sagebrush, Balsamroot, Reapvine, Toadflax, Lupine, Crepis, Fleabane, Alumroot, Geranium, Bedstraw, Rockcress, Yarrow, Dwarf Waterleaf, Pussytoes, Larkspur.

Site 12
Big Sagebrush, Greasewood, Squirreltail, Pepperweed, Cheatgrass, Burrheaded Buttercup, Bassia, Onion.

Site 13
Western Wheatgrass, Big Sagebrush, Indian Paintbrush, Sandberg Bluegrass, Prairie Junegrass, Low Rabbitbrush, Winterfat, Cactus, Stemless Goldenwood, Globemallow, Fleabane, Longleaf Phlox, Arrowleaf Balsamroot, Groundsel, Astragalus, Hoods Phlox, Hollyleaf Clover, Milkvetch, Lomatium, Wooly Loco, Death Camas.

Site 14
Big Sagebrush, Snowberry, Bitterbrush, Serviceberry, Rabbitbrush, Gambell Oak, Lupine, Pussytoes, Dandelions, Bluebunch Wheatgrass, Nevada Bluegrass, Elk Sedge, Kentucky Bluegrass, Letterman's Needlegrass, Big Bluegrass, Bluebells, Senecio, Larkspur, Milkvetch, Crepis, Buckwheat, Fleabane, Biscuitroot.

Site 15
Kentucky Bluegrass, Yarrow, Dandelion, Prostrate Knotweed Big Sagebrush, Herbaceous Sagebrush.

Site 16
Big Sagebrush, Snowberry, Bitterbrush, Low Rabbitbrush, Lupine, Larkspur, Mutton Bluegrass, Asters, Flax, Needlegrass, Elk Sedge, Indian Paintbrush, Bedstraw, Death Camas, Milkvetch, Fleabane, Senecio, Serviceberry, Buckwheat.

Site 17
Big Sagebrush, Bitterbrush, Snowberry, Gambell Oak (scattered), Serviceberry, Muttongrass, Needlegrass, Juniper (scattered), Low Rabbitbrush, Indian Paintbrush, Prickly Pear, Lupine, Larkspur, Death Camas, Senecio, Vetch, Flax, Fleabane, Elk Sedge, Western Wheatgrass, Buckwheat, Buckwheat Wheatgrass, Penstemon, Prairie Junegrass.

Appendix B--(Continued)

Site 18
Aspen Tree, Serviceberry, Snowberry, Chokecherry, Aspen Peavine, Sweet Anise, Bedstraw, Columbine, Purple Violet, Cinquefoil, Rose, Oregon Grape, Alumroot, Elk Sedge, Mountain Brome, Kentucky Bluegrass, Meadow Rue, Mountain Dandelion, Astragalus.

Site 19
Western Wheatgrass, Needle-and-Thread Grass, Prairie Junegrass, Sandberg Bluegrass, Nevada Bluegrass, Big Sagebrush, Low Rabbitbrush, Serviceberry, Smooth Horsebrush, Milkvetch, Fleabane, Lomatium, Phlox, Cactus, Lupine, Indian Paintbrush, Globemallow, Crepis, Hollyleaf Clover, Pussytoes, Death Camas, Pinyon, Juniper, Agoseris.

Site 20
Pinyon, Juniper, Serviceberry, Mountain Mahogany, Snowberry, Big Sagebrush, Low Rabbitbrush, Bluebunch Wheatgrass, Elk Sedge, Western Wheatgrass, Prairie Junegrass, Nevada Bluegrass, Needle-and-Thread Grass, Cactus, Aribis, Western Wallflower, Fleabane, Agoseris, Globemallow.

Site 21
Big Sagebrush, Greasewood, Greens Rabbitbrush, Western Wheatgrass, Indian Ricegrass, Annual Buckwheat, Cactus, Gilia, Mustard, Western Wallflower, Bladderpod, Bluebunch Wheatgrass.

Site 22
Greasewood, Big Sagebrush, Tall Rabbitbrush, Western Wheatgrass, Nevada Bluegrass, Squirreltail, Cheatgrass, Western Wallflower, Fleabane, Larkspur, Tarweed, Cactus, Mustard, Pigweed.

Site 23
Greasewood, Shadscale, Big Sagebrush, Winterfat, Western Wheatgrass, Squirreltail, Sandberg Bluegrass, Onion, Metaster, Cactus, Globemallow.

Site 24
Big Sagebrush, Juniper (scattered), Winterfat, Cactus, Western Wheatgrass, Needle-and-Thread Grass, Prairie Junegrass, Nevada Bluegrass, Sandberg Bluegrass, Elk Sedge, Phlox, Woolly Loco, Globemallow, Indian Paintbrush, Hollyleaf Clover, Fleabane, Crepis, Stemless Goldenweed, Sego Lily.

Site 25
(Smooth Brome Pasture), Basin Wildrye, Kentucky Bluegrass, Big Sagebrush, Tall Rabbitbrush, Larkspur, Purple Mustard, Yellow Mustard, Pigweed.

Site 26
Bluebunch Wheatgrass, Elk Sedge, Needle-and-Thread Grass, Sandberg Bluegrass, Muttongrass, Indian Ricegrass, Western Wheatgrass, Squirreltail, Phlox, Fleabane, Bladder Pod, Sandwort, Hollyleaf Clover, Balsamroot, Western Wallflower, Stemless Golden Weed, Mountain Mahogany,

Crytantha, Big Sagebrush, Pinyon, Juniper.

Site 27
Big Sagebrush, Low Rabbitbrush, Needle-and-Thread Grass, Muttongrass, Dry Land Sedge, Indian Ricegrass, Sandberg Bluegrass, Bluebunch Wheatgrass, Western Wheatgrass, Death Camas, Lupine, Indian Paintbrush, American Vetch, Hollyleaf Clover, Gilia, Phlox, Senecio, B. Toadflax, Fleabane, Buckwheat, Crepis, Prairie Junegrass, Crytantha, Sandwort. Penstemon.

Site 28
Bluegrasses, Buckwheat, Bottlebrush, Squirreltail, Onion, Western Wheat, Fleabane, Phlox, Hollyleaf Clover, Indian Paintbrush, Arrowleaf Balsamroot, Nevada Bluegrass, Sandberg Bluegrass, Prairie Junegrass.

Site 29
Violet, Big Sage, Geranium, Chokecherry, Snowberry, Vetch, Rose, Meadow Rye, Sedge, Larkspur, Lupine, Gambell Oak, Western Wheat, Yarrow, Bedstraw, Cowbane, Phlox, Blue Columbia, Serviceberry, Pussytoes.

Site 30
Aspen, Snowberry, Chokecherry, Onion Grass, Columbia Needlegrass, Bluegrasses, Aspen Peavine, American Vetch, Yarrow, Colorado Blue Rye, Nodding Brome, Mountain Brome, Mint, Sweet Anise, Strawberry, Larkspur.

Site 31
Alkaline Sage, Western Wheatgrass, Crested Wheatgrass, Fleabane, Yarrow, Colorado Rubber Weed, Prairie Junegrass, Sandberg Bluegrass.

Site 32
Greasewood, Alkaline Sage, Western Wheatgrass, Onion, Fleabane, Bottlebrush Squirreltail.

Site 33
Sedges, Rushes, Narrow Leaf Sedge.

Site 34
Big Sage, Wild Onion, Western Wheatgrass, Bluegrass, Low Rabbitbrush.

Site 35
Big Sage, Serviceberry, Mountain Brome, Yarrow, Bluegrass, Snowberry.

Site 36
Big Sage, Snowberry, Serviceberry, Slender Wheatgrass, Mountain Big Bluegrass Lupine, Mountain Brome, Lettermans Needlegrass, Yarrow, Columbia Needlegrass.

Appendix C

The purpose of this section of the report is to provide an up-to-date listing of references pertaining to vegetation establishment and management on lands disturbed by mining in the western United States. The listing covers the period 1970 through mid-1975.

The information shown here was taken from a draft prepared by the Western Regional Coordinating Committee (WRCC-21) on massive displacement of land from Coal and Oil Shale development. September, 1975.

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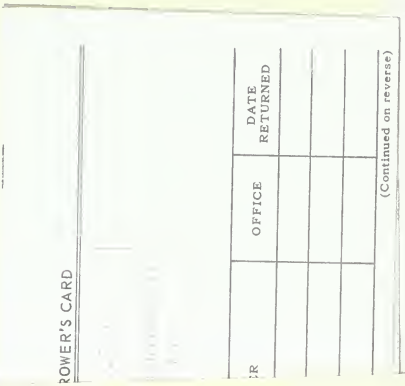

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